ESA section 7 Consultation Number F/NWR/2001/01191

National Marine Fisheries Service Endangered Species Act (ESA) Section 7 Consultation
Biological Opinion and Magnuson–Stevens Act Essential Fish Habitat Consultation

Action Agencies: The National Marine Fisheries Service (NMFS)
The U.S. Department of Agriculture Forest Service (USFS)
The U.S. Environmental Protection Agency (EPA)
The U.S. Geological Survey (USGS)
The Federal Energy Regulatory Commission (FERC)
The Bonneville Power Administration (BPA)
The U.S. Bureau of Reclamation (USBR)

Species/ESUs Affected: Middle Columbia River (MCR) steelhead (*Oncorhynchus mykiss*)

Activities Considered:

1. Issuance of Permit No. 1056 to NMFS' Northwest Fisheries Science Center (NWFSC).
2. Issuance of Permit No. 1140 to the NWFSC.
3. Issuance of Permit No. 1156 to the EPA.
4. Issuance of Permit No. 1229 to the Northern Wasco County (Oregon) Public Utility District (PUD).
5. Issuance of Permit No. 1252 to Washington Department of Transportation (WDOT).
6. Issuance of Permit No. 1290 to the NWFSC.
7. Issuance of Permit No. 1291 to the USGS.
8. Issuance of Permit No. 1292 to the USFS.
9. Issuance of Permit No. 1293 to Northern Resource Consulting (NRC).
10. Issuance of Permit No. 1317 to the USGS.
11. Issuance of Permit No. 1318 to the Oregon Department of Fish and Wildlife (ODFW).
12. Issuance of Permit No. 1321 to Mr. Kenneth Witty.
13. Issuance of Permit No. 1322 to the NWFSC.
14. Issuance of Permit No. 1335 to the USFS.
15. Issuance of Permit No. 1340 to Oregon State University (OSU).
16. Issuance of Permit No. 1345 to The Washington Department of Fish and Wildlife (WDFW).

Consultation Conducted by: The Protected Resources Division (PRD), Northwest Region, NMFS Consultation Number F/NWR/2001/01191

Approved by: for D. Robert Lohn, Regional Administrator
Date: __________ (**Expires on:** December 31, 2006)

This Biological Opinion (Opinion) constitutes NMFS' review of 12 ESA section 10(a)(1)(A) permit applications and four permit modifications that could affect MCR steelhead. It has been prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). It is based on information provided in the applications for the proposed permits and permit modifications, published and unpublished scientific information on the biology and ecology of threatened steelhead in the action area, and other sources of information. A complete administrative record of this consultation is on file with the PRD in Portland, Oregon.

CONSULTATION HISTORY

NMFS proposes to issue 12 permits and four permit modifications and thereby authorize the permit holders to conduct scientific research on threatened MCR steelhead. The Northwest Region's PRD decided to group these actions in a single consultation pursuant to 50 CFR 402.14(c) because they are similar in nature and will affect the same threatened species. Though some of these permits may affect other species, this Opinion constitutes formal consultation and an analysis of effects solely for MCR steelhead. The consultation histories for each of the permits and modifications are described below.

Permit No. 1056—for the NWFSC.

On December 20, 1999, the PRD received a request to modify the NWFSC's Permit No. 1056. The permit had been in place for a number of years and had been modified (and consulted on) twice previously. The reasons for this modification were to take a new study, new field personnel, and newly-listed species into account. The request included an amended study plan.

Permit No. 1140—for the NWFSC.

On April 2, 2001, the PRD received a request to reinitiate consultation on the NWFSC's proposal to modify a permit that had been issued to John Stein. The request included a copy of the modified application.

Permit No. 1156—for the EPA.

On February 28, 2001, the PRD received a research permit modification request from Dynamac Corporation—a research contractor to the EPA in Corvallis, Oregon. Dynamac desired to modify the existing permit 1156 by adding research being carried out by the Washington Department of Ecology (DOE) and the USGS under a cooperative agreement. The application included site descriptions and a list of the field personnel for the USGS and DOE efforts.

Permit No. 1229—for the Northern Wasco County PUD.

On December 9, 1999, the PRD received a revised permit application from the Northern Wasco County PUD to take a number of listed species under their FERC-licensed project at The Dalles Dam on the Columbia River. The application was twice updated with letters amending the projected take numbers for various species. The last such revision was received on April 14, 2000.

Permit No. 1252—for the WDOT.

On April 19, 2000, the PRD received a permit application from the WDOT to take various listed species in Washington State (primarily Western Washington). After examining the application, the PRD requested, and received on May 22, 2000, the applicant's estimated take numbers for the species involved.

Permit No. 1290—for the NWFSC

On March 1, 2001, the PRD received a research permit application from the NWFSC. The application was accompanied by a proposed study plan. It should be noted that Permit No. 1290 actually covers two studies that have been combined into one permit. The application for the other study (now part of Permit No. 1290) was received on December 14, 2000.

Permit No. 1291—for the USGS.

On January 23, 2001, the PRD received a research permit application from the USGS in Cook, Washington. The application was accompanied by a letter from the applicant explaining the need to apply for a new permit rather than (drastically) modify an existing permit (1130) to cover the proposed activities.

Permit No. 1292—for the USFS

On February 12, 2001, the PRD received an application for a research permit from the USFS Pacific Northwest Research Station in La Grande, Oregon.

Permit No. 1293—for NRC.

On January 18, 2001, the PRD received a research permit application from NRC in Longview, Washington.

Permit No. 1317—for the USGS.

On February 6, 2001, the PRD received a research permit application from the USGS in Cook, Washington. The PRD subsequently asked for, and received on May 17, 2001, a number of clarifications regarding the application.

Permit No. 1318—for the ODFW.

On February 8, 2001, the PRD received a research permit application from the ODFW in Portland, Oregon, for ongoing studies in a number of areas inhabited by listed species throughout Oregon.

Permit No. 1321—for Mr. Kenneth Witty.

On May 23, 2001, the PRD received a research permit application from Mr. Kenneth Witty of Enterprise, Oregon. After reviewing the application, the PRD subsequently asked for, and received on May 17, 2001, a revised application containing a number of clarifications regarding the original application.

Permit No. 1322—for the NWFSC.

On May 17, 2001, the PRD received a research permit application from the NWFSC. The PRD subsequently asked for, and received on June 8, 2001, a revised application containing a number of clarifications regarding the original application.

Permit No. 1335—for the USFS.

On May 10, 2001, the PRD received a research permit application from the USFS. The PRD subsequently asked for, and received on July 1, 2001, a revised set of tables that more completely and accurately described the expected take associated with the USFS research.

Permit No. 1340—for OSU.

On December 1, 2000, the PRD received a revised application from OSU in Corvallis, Oregon. The application was accompanied by an e-mail explaining that the projected take numbers had been adjusted so as not to include non-listed hatchery fish. The original application was received on October 17, 2000.

Permit No. 1345—for the WDFW

On June 8, 2001, the PRD receive a permit application from the WDFW to take various listed salmonid species in the Puget Sound and in the Columbia and Snake River basins during the course of evaluating Washington State's warmwater fisheries.

DESCRIPTION OF THE PROPOSED ACTIONS

Common Elements among the Proposed Actions

First, NMFS proposes that all 16 of the permit actions considered in this Opinion should be in effect for five years; that is they would expire on December 31, 2006. Also, in all instances where a permit holder does not expect to indirectly kill any juvenile MCR steelhead during the course of his or her work, the indirect lethal take figure has been set at one. The reason for this is that unforseen circumstances can arise on occasion and NMFS has determined it is best in these instances to include modest overestimates of expected take. By doing this, NMFS gives researchers enough flexibility to make in-season research protocol adjustments in response to annual fluctuations in environmental conditions—such as water flows, larger than expected run sizes, etc.—without having to shut down the research because the expected take was exceeded. Also, high take estimates are useful for conservatively analyzing the effects of the actions because it allows accidents that could cause higher-than-expected take levels to be included in the analysis.

Research permits list general and special conditions to be followed before, during, and after the research activities are conducted. These conditions are intended to (a) manage the interaction between scientists and ESA-listed salmonids by requiring that research activities be coordinated among permit holders and between permit holders and NMFS, (b) require measures to minimize impacts on listed species, and (c) report to NMFS information on the effects the permitted activities have on the species concerned. The following conditions are common to all of the permits. In all cases, the permit holder must:

1. Anesthetize each ESA-listed fish that is handled out-of-water. Anesthetized fish must be allowed to recover (e.g., in a recovery tank) before being released. Fish that are simply counted must remain in water and do not need to be anesthetized.

2. Handle each ESA-listed fish with extreme care and keep them in water to the maximum extent possible during sampling and processing procedures. The holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix of species, ESA-listed fish must be processed first to minimize the duration of handling

stress. The transfer of ESA-listed fish must be conducted using a sanctuary net when necessary to prevent the added stress of an out-of-water transfer.

3. Stop handling ESA-listed juvenile fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.

4. Use a sterilized needle for each individual injection when using a passive integrated transponder tag (PIT-tag) to mark ESA-listed fish. This is done to minimize the transfer of pathogens between fish.

5. Notify NMFS in advance of any changes in sampling locations or research protocols and obtain approval before implementing those changes.

6. Not intentionally kill (or cause to be killed) any ESA-listed species the permit authorizes to be taken, unless the permit allows lethal take.

7. Exercise due caution during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA-listed adult salmonids when they are spawning. Whenever possible, walking in the stream must be avoided—especially in areas where ESA-listed salmonids are likely to spawn.

8. Use visual observation protocols instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining whether anadromous fish are present. Snorkeling and streamside surveys should replace electrofishing procedures whenever possible.

9. Comply with NMFS' backpack electrofishing guidelines when using backpack electroshocking equipment to collect ESA-listed fish.

10. Report to NMFS whenever the authorized level of take is exceeded or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than two days after the authorized level of take is exceeded. Researchers must then submit a detailed written report. Pending review of these circumstances, NMFS may suspend research activities or reinitiate consultation before allowing research activities to continue.

11. Submit to NMFS a post-season report summarizing the results of the research. The report must include a detailed description of activities, the total number of fish taken at each location, an estimate of the number of ESA-listed fish taken at each location, the

manner of take, the dates/locations of take, and a discussion of the degree to which the research goals were met.

Additional permit conditions specific to each of the proposed research are included in the descriptions of the respective permits.

Some of the activities identified in the proposed permit actions will be funded by NMFS, the USFS, the EPA, the USGS, and FERC. Although these agencies are also responsible for complying with section 7 of the ESA because they are funding activities that may affect listed species, this consultation examines the activities they propose to fund and thus will fulfill their section 7 consultation requirement.

Finally, NMFS will monitor actual annual takes of ESA-listed fish species associated with scientific research activities (as provided to NMFS in annual reports or by other means) and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

The Individual Permits

The following table displays the overall amounts of take being requested in each permit application and the general actions with which that take would be associated. “Take” is defined in section 3 of the ESA; it means to harass, harm, pursue, hunt, shoot, wound, kill, trap capture or collect [a listed species] or to attempt to engage in any such conduct. The table’s purpose is to depict the total impact—strictly in terms of pure take numbers—that can be expected from the proposed research activities. Detailed, action-by-action breakdowns (i.e., how much take is associated with each activity in each permit) are found in the Determination of Effects section.

Table 1. Summary of the Proposed Research Permits Considered in this Biological Opinion.

Permit No.	*Adult MCR Steelhead Take Requested (per year)*	*Juvenile MCR Steelhead Take Requested (per year)*	*Proposed Activities*	*Location(s)*
1056	0	500 Direct mortality: 200* Indirect mortality: 10*	Capture/handle/ sacrifice	John Day River and tributaries
1140	0	2 Indirect mortality: 1	Capture/handle/ release	Columbia River Estuary
1156	12 Indirect mortality: 0	35 Indirect mortality: 1	Adult: Capture/handle/ release Juvenile: Capture/handle/ release	Shellneck and Nelson Creeks, WA; the Deschutes and John Day Rivers, OR
1229	0	6 Indirect mortality: 1	Capture/handle/ release	The Dalles Dam
1252	0	10 Indirect mortality: 1	Capture/handle/ release	Klickitat, Walla Walla, and Yakima River subbasins; Columbia mainstem
1290	0	12 Indirect mortality: 1	Capture/handle/ release	Columbia River Estuary
1291	0	4330 Indirect mortality: 87	Capture/handle/ tag/release	John Day and Bonneville Dams
1292	0	23 Indirect mortality: 1	Capture/handle/ tissue sample/ release	Quartz and S. Fk. Quartz Creeks and Naches River
1293	0	28 Indirect mortality: 1	Observe/harass/ capture/handle/ release	Headwaters areas in several OR and WA counties
1317	0	500 Indirect mortality: 25	Capture/handle/ mark/release	Toppenish Creek

Table 1. Summary of the Proposed Research Permits Considered in this Biological Opinion.

Permit No.	*Adult MCR Steelhead Take Requested (per year)*	*Juvenile MCR Steelhead Take Requested (per year)*	*Proposed Activities*	*Location(s)*
1318	5 Indirect mortality: 0	20 Indirect mortality: 1	Capture/handle release	Deschutes River
1321	0	400 Indirect mortality: 20	Capture/handle/mark/transport/release	Yakima River subbasin
1322	0	10 Indirect mortality: 1	Capture/handle/release	Columbia River Estuary
1335	0	500 Indirect mortality: 15	Capture/handle/release	Wenatchee National Forest
1340	0	240 Indirect mortality: 6	Observe/capture/handle/stomach pump/release	John Day River subbasin
1345	1 Indirect mortality: 0	2 Indirect mortality: 1	Capture/handle/release	Walla Walla and Columbia Rivers

*Direct mortality represents fish that are killed on purpose as part of the research; indirect mortality represents fish that are killed by accident when the research is conducted.

Many of the permit requests described in the following pages seek to take other listed salmonids along with MCR steelhead (e.g., upper Columbia River steelhead, Upper Willamette River chinook). The effects of taking those other species are described in other biological opinions and are not relevant to this consultation. Therefore, only those portions of the proposed research activities that would affect MCR steelhead are discussed here.

Permit 1056:

Permit 1056 would authorize the NWFSC to annually take juvenile MCR steelhead during research activities in the John Day River subbasin in Oregon. The purpose of the research is to determine the relationship between adult salmonid carcass density and subsequent marine-derived nutrient enrichment in juvenile salmonids. It will benefit the listed steelhead by helping determine the impacts that reductions in adult salmonid carcasses (and thus marine nutrients) have on subsequent steelhead productivity. The researchers would capture juvenile fish at up to 20 sites by electrofishing, seining, dip-netting, minnow-trapping, and angling. The fish would be sacrificed and their tissues sampled and examined for marine-derived nutrient content. Some tissue samples from the juvenile fish—along with some stomachs and their contents—would be shared with Shoshone-Bannock tribal biologists under a cooperative agreement, and some tissue samples may be sent to another NWFSC biologist. This is the third modification the NWFSC has requested for permit 1056. The original request and the other two modifications have already undergone the full consultation process and the research under this latest modification would take place in conjunction with those previously-approved activities.

Permit 1140:

Permit 1140 would authorize the NWFSC to annually take juvenile MCR steelhead during research activities in the Columbia River Estuary. The purpose of the research is to determine the effects that environmental variables, selected anthropogenic stresses, and bacteriological and parasitic pathogens have on disease-induced mortalities among fall chinook salmon in selected coastal estuaries. The research will benefit salmonids by helping managers understand how natural and human-caused stresses affect predation, prey, and disease among salmonids which, in turn, will give insight into long-term trends in production. The researchers would use beach seines, mid-water purse seines, and fyke nets to capture the fish, but because the study targets fall chinook salmon rather than steelhead, it is likely that few, if any MCR steelhead will be captured. The request is for a modification of a previous version of Permit 1140. It incorporates new take numbers (see Table 1) and adds a study on salmon in Puget Sound.

Permit 1156:

Permit 1156 would authorize the EPA and Dynamac Corporation to annually take juvenile MCR steelhead during research activities designed to assess status and trends of surface waters in the Pacific Northwest in a statistically and ecologically rigorous manner. The overall program is mandated by the Clean Water Act. In carrying it out, the EPA conducts surveys for fish, macroinvertebrates, algae, and microbial assemblages as well as physical and chemical habitat conditions in randomly selected river systems in Oregon, Washington, and Idaho. The research will benefit MCR steelhead by providing baseline information to support enforcement of the Clean Water Act in freshwater river systems where they may be present. During the course of the proposed surveys, ESA-listed juvenile fish would be captured by electrofishing (using backpack or raft-mounted gear), examined, and released. Dynamac Corporation is a cooperator with the scientific research and its biologists are authorized to act as agents of EPA in conducting the research. Dynamac Corporation is also requesting a small amount of (non-lethal) take for adult MCR steelhead that may be encountered, and a small amount of take for juveniles that may be killed as an indirect result of the research.

Permit 1229:

Permit 1229 would authorize the Northern Wasco County PUD to annually take juvenile MCR steelhead during the course of scientific research and monitoring activities at The Dalles Dam on the Columbia River. Permit 1229 would replace Permit 948, which expired on September 30, 1999. The FERC requires the Northern Wasco County PUD to monitor the effectiveness of their fish passage facility at The Dalles Dam. The purpose of this ongoing monitoring effort is to examine the condition of juvenile fish passing through the facility, to maintain passage efficiency and minimize injury. Continued observation of individual fish passing through the screened intake channel during the smolt migration season provides specific information on possible unsuitable passage conditions below the water surface which are not directly observable. The PUD proposes to intercept ESA-listed juvenile salmonids in the screened turbine intake channel at the dam and convey them through a screened chute into an overflow tank. The juvenile salmonids will then be examined for external injuries and released.

Permit 1252:

Permit 1252 would authorize the WDOT to annually take juvenile MCR steelhead during the course of presence/absence surveys in water bodies crossed by or adjacent to state transportation systems (highways, railroads, or airports) in Washington State. The surveys will be used to assess potential impacts of the WDOT projects on ESA-listed fish species. The survey work will benefit the species by providing information that will enable the WDOT to establish specific timing restrictions for in-water work windows and to implement best management practices designed to protect ESA-listed species. The surveys will also collect information on where ESA-listed species are located. The WDOT proposes to observe/harass ESA-listed juvenile fish during snorkel surveys or capture them (using dip nets, seines, minnow traps, rod and reel, or electrofishing), handle, and release them. The WDOT also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1290:

Permit 1290 would authorize the NWFSC's Fish Ecology Division to annually take juvenile MCR steelhead during the course of two scientific research studies to be conducted in the Columbia River estuary. The purpose of Study 1 is to evaluate the importance of the Columbia River estuary to baitfish populations and salmonid survival. The study will benefit listed salmonids by providing information on the relationship between baitfish abundance and salmonid survival in the estuary and marine environments. The purpose of Study 2 is to determine the prevalence and intensity of pathogens in juvenile salmonids. The study will benefit ESA-listed salmonids by contributing information on the extent to which diseases affect the growth and survival of juvenile salmonids in the estuarine and nearshore environments. Study 2 is intended to complement the pathogen research that is being conducted by the NWFSC's Environmental Conservation Division under scientific research Permit 1140. ESA-listed juvenile fish will be captured by purse seine or beach seine, handled (anesthetized, identified, and measured), and released or taken lethally. The NWFSC also request take for MCR steelhead that may be killed as an indirect result of the research. However, any MCR steelhead chinook salmon juvenile indirect mortalities will be retained for Study 2 in the place of intentional lethal takes. The NWFSC also requests the use of the juvenile bypass system at Bonneville Dam as a backup sampling location for Study 2 should the researcher not be able to collect enough test fish in the estuary or should sampling in the estuary not be possible.

Permit 1291:

Permit 1291 would authorize the USGS's Columbia River Research Laboratory to annually take juvenile MCR steelhead during the course of scientific research at The Dalles, John Day, and Bonneville Dams on the lower Columbia River. The purpose of the research is to monitor (using radio telemetry) juvenile fish movement, distribution, behavior, and survival from John Day Dam downstream past Bonneville Dam. The research will benefit listed salmonids by providing information on spill effectiveness, forebay residence times, and guidance efficiency under various flow regimes that will allow Federal resource managers to make adjustments to bypass/collection structures to optimize downriver migrant survival at the hydropower projects. The proposed research is intended to complement research the USGS is conducting under scientific research Permit 1130. Under Permit 1291, ESA-listed juvenile fish would be either (1) captured by Smolt Monitoring Program (SMP) personnel at Bonneville and John Day Dams, handled, and released or (2) captured by SMP personnel and given to USGS personnel and implanted with radio transmitters, transported, held for as long as 24 hours, released, and tracked electronically. The USGS requests that SMP personnel be allowed to act as agents of the USGS under the proposed permit. The USGS also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1292:

Permit 1292 would authorize the USFS Pacific Northwest Research Station to annually take juvenile MCR steelhead during the course of research to be conducted in the Yakima and Wenatchee Rivers in Washington. The purpose of the research is to determine the extent and distribution of hybridization between westslope cutthroat trout (*O. clarki*), rainbow trout *(O. mykiss*), and anadromous steelhead among selected populations in the mid- and upper Columbia River basins. The research will benefit listed salmonids by providing information on westslope cutthroat trout and rainbow trout/steelhead interactions and could provide insight into possible genetic introgression of introduced rainbow trout stocks in the areas of native rainbow trout/steelhead distribution. The USFS also proposes to analyze phenotypic characteristics that may be used by biologists in the future to more definitively distinguish cutthroat trout, rainbow trout/steelhead, and hybrid forms in the field. ESA-listed juvenile fish will be captured by angling with flies with barbless hooks. After the juvenile steelhead is captured, the researchers will take small tissue samples their caudal fins and release them. The USFS also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1293:

Permit 1293 would authorize NRC to annually take juvenile MCR steelhead during the course of scientific research to be conducted in numerous headwater streams throughout Oregon and Washington (Klickitat, Skamania, Columbia, Clatsop, Clark, Wahkiakum, Cowlitz, and Pacific Counties). The purpose of the research is to determine where juvenile fish are present on privately owned timberlands and to provide the Washington Department of Natural Resources, the Oregon Department of Forestry, and other state agencies with information to be used in updating fish distribution maps. The research will benefit listed salmonids by providing information that would (a) show the upper extent of fish usage in headwater streams, (b) help locate potential stream blockages that may inhibit anadromous fish migration, and (c) assist small landowners with culvert projects that could increase the available fish habitat. Juvenile MCR steelhead will be observed/harassed or captured (using electrofishing or angling), handled, and released. Northern Resource Consulting also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1317:

Permit 1317 would authorize the USGS to annually take juvenile MCR steelhead during the course of research activities on the Toppenish National Wildlife Refuge (TNWR), Toppenish Creek, Washington. The purpose of the study is to determine whether juvenile MCR steelhead enter the TNWR's wetland management units during the spring flooding of Toppenish Creek and becoming trapped there—thus becoming vulnerable to avian predators, high summer water temperatures, and stranding. The study will benefit MCR steelhead by showing whether they are (a) straying into the wetland management units and (b) managing to escape back to Toppenish Creek to continue their downstream migration. If the juvenile MCR steelhead are being trapped in the management units by falling water levels, the study will also be used to help guide TNWR operations so that the fish are less likely to be harmed in the future. The USGS proposes to capture, handle, and release juvenile MCR steelhead. Baited minnow traps will be the primary capture method, but fyke nets or electrofishing may be used if the traps are not successful. The USGS also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1318:

Permit 1318 would authorize the ODFW to annually take juvenile MCR steelhead during the course of conducting scientific research on the Deschutes River in Oregon. The purpose of the research is to estimate population numbers and record individual fish metrics among redband trout in the Deschutes River, Oregon. The project will benefit listed salmonids by helping assess the health of the fish community in the lower 100 miles of the Deschutes River and by helping managers determine if fluctuations in local anadromous fish populations are the result of mortality occurring during the freshwater stages of their life cycles. The ODFW therefore requests permission to capture, handle, and release juvenile and adult MCR steelhead while conducting boat electrofishing transects for redband trout in the Deschutes River. The ODFW requests take for juvenile MCR steelhead that may be killed as an indirect result of these activities. They are also seeking a permit that would allow them a small amount of annual, non-lethal take of adult MCR steelhead.

Permit 1321:

Permit 1321 would authorize Mr. Kenneth Witty to annually take juvenile MCR steelhead during the course of scientific research in the Yakima River subbasin in Washington. The purpose of the research is to study fish communities in the irrigation drainage networks of the lower Yakima River subbasin and determine the extent to which threatened steelhead inhabit those networks. The research will benefit threatened MCR steelhead by giving Federal managers data on where the fish are in the Yakima subbasin irrigation system—thus helping them make decisions about how to run the system in a way that conserves the species. Mr. Witty proposes to capture (using backpack electrofishing equipment), handle, tag, and release juvenile MCR steelhead. Mr. Witty also requests take for juvenile MCR steelhead that may be killed as an indirect result of these activities.

Permit 1322:

Permit 1322 would authorize the NWFSC to annually take juvenile MCR steelhead during the course of scientific research activities in the Columbia River Estuary. The purpose of the research is to derive presence and abundance information for fall and spring chinook, coho (*O. kisutch*), and chum (*O. keta*) salmon at monthly intervals throughout the year. The research will benefit listed salmonids by providing information that will serve as the basis for salmonid habitat restoration and preservation plans in the lower Columbia River and the estuary. The researchers will use beach seines and trapnets to capture juvenile salmonids. The NWFSC also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1335:

Permit 1335 would authorize the USFS to annually take juvenile MCR steelhead during the course of research activities on the mainstems and North and South Forks of both the Taneum and Manastash Rivers (and various tributaries to them). The purpose of the research is to determine the distribution and abundance of various fish species in those areas and use that information to help develop a model for assessing watershed health. The MCR steelhead will benefit from the research because it will (a) help managers know where the fish are and (b) give them a better picture of watershed health on the Wenatchee National Forest (which, in turn, will help them manage for healthier watersheds). The researchers will use backpack electrofishing equipment to capture MCR steelhead. The captured fish will be held for a brief time, measured, and released. The USFS also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1340:

Permit 1340 would authorize OSU researchers to annually take juvenile MCR steelhead during the course of scientific research in the John Day River subbasin. The purpose of the research is to describe how riparian, terrestrial, and aquatic habitats interact—particularly with respect to food availability and habitat use among steelhead. It will benefit the species by increasing understanding of how various habitat components act to support steelhead, and that knowledge, in turn, will be applied to riparian habitat restoration activities. The researchers will primarily observe fish during snorkel surveys, but some will be captured by angling with barbless flies. These latter fish will be anesthetized, have their stomachs pumped, be allowed to recover, and released. It should be noted that all sample sites for MCR steelhead are considered back-up sites. It is possible—if there is no difficulty with the primary planned sites—that no MCR steelhead would be taken at all under this permit. In any case, the researchers also request take for juvenile MCR steelhead that may be killed as an indirect result of the research.

Permit 1345:

Permit 1345 would authorize WDFW researchers to annually take juvenile and adult MCR steelhead during the course of boat fishing operations in the Walla Walla and mainstem Columbia Rivers. The purpose of the research is to assess warm water fish populations throughout the state and therefore MCR steelhead would not be the target of the research. However, MCR steelhead would benefit from the research because it will help WDFW fish managers evaluate fish populations over time and thereby give them better understanding of species interactions, fish population function, and species' responses to various harvest regimes and management strategies. This information will, in turn, be used to better manage fisheries throughout the state in the future—including fisheries that have the potential to affect MCR steelhead. The WDFW also requests take for juvenile MCR steelhead that may be killed as an indirect result of the research.

The Action Area

The action area for threatened MCR steelhead is the MCR subbasin—including the species' designated critical habitat (NOAA 2000). Critical habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches in hydrologic units and counties identified in Table 24 of NOAA 2000. Accessible reaches are those within the historical range of the ESU that can still be occupied by any steelhead life stage. Critical habitat is designated to include all river reaches accessible to listed steelhead in Columbia River tributaries (except the Snake River) between Mosier Creek in Oregon and the Yakima River in Washington (inclusive). The riparian zones adjacent to these stream reaches are also included in the critical habitat designation, as are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the Yakima River in Washington. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river subbasins containing spawning and rearing habitat for this ESU comprise approximately 26,739 square miles in Oregon and Washington. The following counties lie partially or wholly within these subbasin s (or contain migration habitat for the species): Oregon—Clatsop, Columbia, Crook, Gilliam, Grant, Harney, Hood River, Jefferson, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, Wasco, and Wheeler; Washington—Benton, Clark, Columbia, Cowlitz, Franklin, Kittitas, Klickitat, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima. More detailed critical habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for this ESU can be found in the Federal Register notice designating their critical habitat (February 16, 2000, 65 FR 7764).

STATUS OF THE SPECIES UNDER THE ENVIRONMENTAL BASELINE

In order to describe a species' status, it is first necessary to define precisely what "species" means in this context. Traditionally, one thinks of the ESA listing process as pertaining to entire taxonomic species of animals or plants. While this is generally true, the ESA also recognizes that there are times when the listing unit must necessarily be a subset of the species as a whole. In these instances, the ESA allows a "distinct population segment" (DPS) of a species to be listed as threatened or endangered. MCR steelhead are just such a DPS and, as such, are for all intents and purposes considered a "species" under the ESA.

NMFS developed the approach for defining salmonid DPSs in 1991 (Waples 1991). It states that a population or group of populations is considered distinct if they are ". . . substantially reproductively isolated from conspecific populations," and if they are considered ". . . an important component of the evolutionary legacy of the species." A distinct population or group populations is referred to as an evolutionarily significant unit (ESU) of the species. Hence, MCR steelhead constitute an ESU of the species *O. mykiss*.

The MCR steelhead ESU was listed as threatened on March 25, 1999 (64 FR 14517). It includes all natural-origin populations in the Columbia River basin above the Wind River, Washington, and the Hood River, Oregon, up to and including the Yakima River, Washington. This ESU includes the only populations of inland winter steelhead in the United States (in the Klickitat River, Washington, and Fifteenmile Creek, Oregon). Both the Deschutes River and Umatilla River hatchery stocks are included in the ESU, but are not listed. Critical habitat (discussed above in the section on the action area) was designated for MCR steelhead on February 16, 2000 (65 FR 7764).

The MCR steelhead were listed because NMFS determined that a number of factors—both environmental and demographic—had caused them to decline to the point where they were likely to be in danger of going extinct within the foreseeable future. These factors for decline affect MCR steelhead biological requirements at every life stage and they arise from a number of different sources. This section of the Opinion explores those effects and defines the context within which they take place.

Species/ESU Life History

<u>Steelhead</u>

Steelhead can be divided into two basic run types based on their level of sexual maturity at the time they enter fresh water and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in fresh water to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns realtively shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, others only have one run type.

In the Pacific Northwest, summer steelhead enter fresh water between May and October (Busby et al. 1996, Nickelson et al. 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson et al. 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson et al. 1992). Winter steelhead enter fresh water between November and April in the Pacific Northwest (Busby et al. 1996, Nickelson et al. 1992), migrate to spawning areas, and then spawn in late winter or spring.

Unlike Pacific salmon, steelhead are capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson et al. 1992). Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation during that time.

Depending on water temperature, steelhead eggs may incubate for 1.5 to four months before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity—primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992).

Juveniles rear in fresh water from one to four years, then migrate to the ocean as smolts. Winter steelhead generally smolt after two years in fresh water (Busby et al. 1996). Steelhead typically reside in marine waters for two or three years before returning to their natal stream to spawn at four or five years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby et al. 1996); for more information on steelhead life histories please see that document (i.e., the *Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California*).

MCR Steelhead

Fish in this ESU are predominantly summer steelhead, but winter-run fish are found in the Klickitat River and Fifteenmile Creek. Most fish in this ESU smolt at two years and spend one to two years in salt water before re-entering fresh water, where they may remain up to a year before spawning. Age-2-ocean steelhead dominate the summer steelhead run in the Klickitat River, whereas most other rivers with summer steelhead produce about equal numbers of both age-1- and 2-ocean fish. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the ESU. Parr usually undergo a smolt transformation as 2-year-olds, at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean prior to returning to spawn in their natal streams. A nonanadromous form of *O. mykiss* (redband trout) co-occurs with the anadromous form in this ESU, and juvenile life stages of the two forms can be very difficult to differentiate. In addition, hatchery steelhead are also distributed within the range of this ESU.

Overview—Status of the MCR Steelhead

To determine a species' status under extant conditions (usually termed "the environmental baseline"), it is necessary to ascertain the degree to which the species' biological requirements are being met at that time and in that action area. For the purposes of this consultation, MCR steelhead biological requirements are expressed in two ways: Population parameters such as fish numbers, distribution, and trends throughout the action area; and the condition of various essential habitat features such as water quality, stream substrates, and food availability. Clearly, these two types of information are interrelated. That is, the condition of a given habitat has a large impact on the number of fish it can support. Nonetheless, it is useful to separate the species' biological requirements into these parameters because doing so provides a more complete picture of all the factors affecting MCR steelhead survival. Therefore, the discussion to follow will be divided into two parts: Species Distribution and Trends; and Factors Affecting the Environmental Baseline.

Species Distribution and Trends

<u>Distribution</u>

Recent adult data for this ESU are summarized in NMFS' biological opinion on the operation of the Federal Columbia River Power System (NMFS 2000a). Estimates of historical (pre-1960s) abundance specific to this ESU are available for the Yakima River, which had an estimated run size of 100,000 (WDF et al. 1993). Assuming comparable run sizes for other drainage areas in this ESU, the total historical run size may have exceeded 300,000 steelhead.

In 1997, NMFS reassessed the status of this ESU (NMFS 1997). Updated dam counts from the Deschutes River showed a 5-year geometric mean of approximately 9,700 summer steelhead in recent runs, corresponding to an escapement of 1,400 natural fish. For 1997, steelhead escapement above Sherars Falls included 17,566 stray hatchery steelhead and 1,729 naturally-produced Deschutes River steelhead. Run reconstructions for the Yakima, John Day, and Touchet Rivers estimate that recent natural escapements are 1,000, 10,000, and 300 steelhead, respectively.

There is very little data on the historical numbers of juvenile outmigrants for the MCR steelhead ESU. In recent years however, the juvenile out migration has been estimated at more than 379,000 fish (Schiewe 2001).

Trends

For the MCR steelhead ESU as a whole, NMFS (2000a) estimates that the median population growth rate over the base period (i.e., data from 1980 to the most recent year available) ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of natural origin fish.

Escapements to the Yakima, Umatilla, and Deschutes River subbasins have shown overall upward trends, although all tributary counts in the Deschutes River are downward, and the Yakima River is recovering from extremely low abundance in the early 1980s. The John Day River probably represents the largest native, naturally-spawning stock in the ESU, and the combined spawner surveys for the John Day River has shown spawner declines of about 15% per year since 1985. NMFS, in proposing this ESU for listing as threatened under the ESA, cited low returns to the Yakima River, poor abundance estimates for Klickitat River and Fifteenmile Creek winter steelhead, and an overall decline for naturally producing stocks within the ESU. However, estimates based on dam counts show an overall increase in steelhead abundance, with a relatively stable naturally-produced component.

Hatchery fish are widespread and stray to spawn naturally throughout the region. Recent estimates of the proportion of natural spawners of hatchery origin range from low (Yakima, Walla Walla, and John Day Rivers) to moderate (Umatilla and Deschutes Rivers). Most hatchery production in this ESU is derived primarily from within-basin stocks. One recent area of concern is the increase in the number of Snake River hatchery (and possibly wild) steelhead that stray and spawn naturally within the Deschutes River subbasin. In addition, one of the main threats cited in NMFS' listing decision for this species was the fact that hatchery fish constituted a steadily increasing proportion of the natural escapement in the MCR steelhead ESU (Fish Passage Center 2000, Brown 1999).

Thus, the degree to which MCR biological requirements are being met with respect to population numbers and distribution is something of a mixed bag. While some improvement can be seen throughout the ESU as a whole, populations in critical subbasins exhibit continuing declining trends. Therefore, while there is some cause for optimism, there has been no genuine change in the species' status since it was listed and the most likely scenario is that its biological requirements are not being met with respect to abundance, distribution, and overall trend.

Factors Affecting the Environmental Baseline

Environmental baselines for biological opinions are defined by regulation at 50 CFR 402.02, which states that an environmental baseline is the physical result of all past and present state, Federal, and private activities in the action area along with the anticipated impacts of all proposed Federal projects in the action area (that have already undergone formal or early section 7 consultation). The environmental baseline for *this* biological opinion is therefore the result of the impacts a great many activities (summarized below) have had on MCR steelhead survival and recovery. Put another way (and as touched upon previously), the baseline is the culmination of the effects that multiple activities have had on the species' *biological requirements* and, by examining those individual effects, it is possible to derive the species' status in the action area.

Many of the biological requirements for MCR steelhead in the action area can best be expressed in terms of the essential features of their critical habitat. That is, the steelhead require adequate: (1) substrate (especially spawning gravel), (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) migration conditions (February 16, 2000, 65 FR 7764). The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids by adversely affecting these essential habitat features. NMFS reviewed much of that information in its recently reinitiated Consultation on Operation of the Federal Columbia River Power System (FCRPS)(NMFS 2000a). That review is summarized in the sections below.

It is important to note that while the discussion below concentrates largely on species other than the MCR steelhead, it is simply a case of there being more data on how the various factors for decline have affected those species than exist for the factors' effects on MCR steelhead. The reason for this is that MCR steelhead were listed fairly recently in comparison to, say, Snake River spring/summer chinook (listed in 1992). As a result, more studies have been done on how the various factors for decline affect species that were listed further in the past. Nonetheless, even though there is not as much data on the MCR steelhead per se, it can be conclusively stated that the factors affecting every other salmonid species in the Columbia River basin affect MCR steelhead as well. Therefore, in every instance cited below—whether hydropower development or habitat destruction or any other factor—it can be said the MCR steelhead have suffered negative effects similar to those described for the species studied. It should be further noted that the discussion below is simply a solid overview—rather than an exhaustive treatment—of the factors affecting MCR steelhead. For greater detail, please see Busby et al. (1996) and NMFS (1991).

The Mainstem Hydropower System

Hydropower development on the Columbia River has dramatically affected anadromous salmonids in the basin. Storage dams have eliminated spawning and rearing habitat and altered the natural hydrograph of the Snake and Columbia Rivers—decreasing spring and summer flows and increasing fall and winter flows. Power operations cause flow levels and river elevations to fluctuate—slowing fish movement through reservoirs, altering riparian ecology, and stranding fish in shallow areas. The 13 dams in the Snake and Columbia River migration corridors kill smolts and adults and alter their migrations. The dams have also converted the once-swift river into a series of slow-moving reservoirs—slowing the smolts' journey to the ocean and creating habitat for predators. Because the MCR steelhead must navigate up to four major hydroelectric projects during their up- and downstream migrations (and experience the effects of other dam operations occurring upstream from their ESU boundary), they feel the influence of all the impacts listed above.

However, ongoing consultations between NMFS and the Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps), the U.S. Fish and Wildlife Service (USFWS), and the Bureau of Reclamation (BOR) have brought about numerous beneficial changes in the operation and configuration of the Columbia River hydropower system. For example, in most years increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems; increased flow in the mainstem Snake and Columbia Rivers provides better inriver conditions for smolts; and better smolt transportation (through the addition of new barges and by modifying existing barges) helps the young salmonids make their way down to the ocean.

It is possible to quantify the survival benefits accruing from many of these strategies for each of the listed salmonid ESUs. To give an example, for Snake River spring/summer chinook salmon smolts migrating inriver, the estimated survival through the hydropower system is now between 40 percent and 60 percent, compared with an estimated survival rate during the 1970s of five percent to 40 percent. Snake River steelhead have probably received a similar benefit because their life history and run timing are similar to those of spring/summer chinook salmon (NMFS 2000b). It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there have been survival improvements for transported fish as well. However, even though there have been a number of improvements, more are needed because the Federal hydropower system continues to kill a significant number of fish from some ESUs.

Several non-Federal projects licensed by the Federal Energy Regulating Commission (FERC) also affect MCR steelhead. Operations of the Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Dams are currently governed by existing FERC license requirements and settlement agreements. Each of these license requirements and settlement agreements specify actions intended to reduce the effects of project operations on anadromous salmonids. For example, a spring flow objective of 135 thousand cubic feet per second at Priest Rapids Dam was established for the MCR in the 1998 FCRPS Supplemental Biological Opinion (NMFS 1998). It is hoped that this and other actions will improve salmon survival, but much remains to be done to offset the effects of hydropower development, and for now the net impact of the hydropower system on MCR steelhead survival is still unequivocally negative. This was especially true for the 2001 juvenile MCR steelhead outmigration because the severe drought conditions at that time made it impossible to meet flow targets in the Columbia River system. As a result, many fish had to be transported down river rather than allowed to migrate naturally. It will take some years before it can be determined what effect this had on salmonid survival in the Columbia Basin.

Human-Induced Habitat Degradation

The quality and quantity of fresh water habitat in much of the Columbia River basin have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydropower system development, mining, and development have radically changed the historical habitat conditions of the basin. More than 2,500 streams, river segments, and lakes in the Northwest do not meet Federally-approved, state and tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. Most of the water bodies in Oregon, Washington, and Idaho on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows which, in turn, contribute to temperature increases. Activities that create shallower streams (e.g., channel widening) also cause temperature increases.

Many waterways in the Columbia River basin fail to meet Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) water quality standards due to the presence of pesticides, heavy metals, dioxins and other pollutants. These pollutants originate from both point- (industrial and municipal waste) and nonpoint (agriculture, forestry, urban activities, etc.) sources. The types and amounts of compounds found in runoff are often correlated with land use patterns: fertilizers and pesticides are found frequently in agricultural and urban settings, and nutrients are found in areas with human and animal waste. People contribute to chemical pollution in the basin, but natural and seasonal factors also influence pollution levels in various ways. Nutrient and pesticide concentrations vary considerably from season to season, as well as among regions with different geographic and hydrological conditions. Natural features (such as geology and soils) and land-management practices (such as storm water drains, tile drainage and irrigation) can influence the movement of chemicals over both land and water. Salmon require clean water and gravel for successful spawning, egg incubation, and fry emergence. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Pollutants, excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres in the Columbia River basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Deficiencies in water quantity have been a problem in the major production subbasins for MCR steelhead (John Day, Deschutes, and Yakima Rivers), all of which have seen major agricultural development over the last century. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the amount and quality of rearing habitat. In fact, in 1993, fish and wildlife agency, tribal, and conservation group experts estimated that 80 percent of 153 Oregon tributaries had low-flow problems (two-thirds of that was caused—at least in part—by irrigation withdrawals) (OWRD 1993). The Northwest Power Planning Council (1992) found similar problems in many Idaho, Oregon, and Washington tributaries.

Blockages that stop downstream and upstream fish movement exist at many dams and barriers, whether they are for agricultural, hydropower, municipal/industrial, or flood control purposes. Culverts that are not designed for fish passage also block upstream migration. Migrating fish are sometimes killed by being diverted into unscreened or inadequately screened water conveyances or turbines. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density which, in turn, affect runoff timing and duration. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil—thus increasing runoff and altering natural hydrograph patterns.

Land ownership has also played its part in the region's habitat and land-use changes. Federal lands, which compose 50 percent of the basin, are generally forested and situated in upstream portions of the watersheds. While there is substantial habitat degradation across all land ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt et al. 1993, Frissell 1993, Henjum et al. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence et al. 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

At the same time some MCR steelhead habitat was being destroyed by water withdrawals in the Columbia basin, water *impoundments* in other areas dramatically reduced MCR steelhead habitat by inundating large amounts of spawning and rearing habitat and reducing migration corridors, for the most part, to a single channel (e.g., Pelton and Round Butte Dams on the Deschutes River). Floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary (through which all the basin's anadromous species—including MCR steelhead—must pass) has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment with multiple channels, extensive wetlands, sandbars, and shallow areas. The mouth of the Columbia River was about four miles wide; today it is two. Winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened, and maintained; jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels; marsh and riparian habitats have been filled and diked; and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet.

More than 50 percent of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted by human use since 1948 (Lower Columbia River Estuary Program [LCREP] 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced and the amount of water discharged during winter has increased.

Human-caused habitat alterations have also increased the number of predators feeding on MCR steelhead. For example, a population of terns on Rice Island (16,000 birds in 1997) consumed an estimated 6-25 million outmigrating salmonid smolts during 1997 (Roby et al. 1998) and 7-15 million outmigrating smolts during 1998 (Collis et al. 1999). Rice Island is a dredged material disposal site in the Columbia River estuary; it was created by the Corps under its Columbia River Channel Operation and Maintenance Program. As another example, populations of Northern pikeminnow (*Ptychocheilus oregonensis*—a voracious predator of salmonids) in the Columbia River have proliferated in the warm, slow-moving reservoirs created by the mainstem dams. Some researchers have estimated the pikeminnow population in the John Day pool alone to be more than one million (Bevan et al. 1994) and they all consume salmonids if given the opportunity.

To counteract all the ill effects listed in this section, Federal, state, tribal, and private entities have—singly and in partnership—begun recovery efforts to help slow and, eventually, reverse the decline of salmon and steelhead populations. Notable efforts within the range of the MCR steelhead ESU are the Basinwide Recovery Strategy, the Northwest Forest Plan, PACFISH, the Washington Wild Stock Restoration Initiative, the Washington Wild Salmonid Policy, and the Oregon Plan for Salmon and Watersheds. (These are all large and complicated programs; for details on these efforts please see the websites for ODFW, WDFW, the USFS, and the Bonneville Power Administration). Nevertheless, despite these efforts, much remains to be done to recover MCR steelhead and other salmonids in the Columbia River basin. Full discussions of these efforts can be found in the referenced documents and in the FCRPS biological opinion.

Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used to (a) produce fish for harvest and (b) replace natural production lost to dam construction and other development—not to protect and rebuild naturally-produced salmonid populations. As a result, most salmonid populations in the region are primarily derived from hatchery fish. In 1987, for example, 95 percent of the coho salmon, 70 percent of the spring chinook salmon, 80 percent of the summer chinook salmon, 50 percent of the fall chinook salmon, and 70 percent of the steelhead returning to the Columbia River basin originated in hatcheries (CBFWA 1990). Because hatcheries have traditionally focused on providing fish for harvest and replacing declines in native runs (and generally not carefully examined their own effects on local populations), it is only recently that the substantial effects of hatcheries on native natural populations been documented. For example, the production of hatchery fish, among other factors, has contributed to the 90 percent reduction in natural coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995).

Hatchery fish can harm naturally produced salmon and steelhead in four primary ways: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS

2000c). Ecologically, hatchery fish can predate on, displace, and compete with wild fish. These effects are most likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Interbreeding can also be caused by humans taking native fish from one area and using them in a hatchery program in another area. Interbred fish are less adapted to the local habitats where the original native stock evolved and may therefore be less productive there.

In many areas, hatchery fish provide increased fishing opportunities. However, when natural fish mix with hatchery stock in these areas, smaller or weaker natural stocks can be over-harvested. Moreover, when migrating adult hatchery and natural fish mix on the spawning grounds, the health of the natural runs and the habitat's ability to support them can be overestimated because the hatchery fish mask the surveyors' ability to discern actual natural run conditions.

Currently, the role hatcheries are to play in the Columbia basin is being redefined under the Basinwide Salmon Recovery Strategy (Federal Caucus 2000). Under this plan hatcheries are being changed from simple production (or "supplementation") hatcheries into hatcheries designed to support species recovery ("conservation" hatcheries). The Program contains two primary hatchery initiatives. The first is to reform all existing production and mitigation hatcheries to eliminate or minimize the harm they do to natural fish. The second is to implement "safety net" projects using various artificial production techniques such as supplementation and captive broodstock programs on an interim basis to avoid extinction while other recovery actions take effect. The artificial propagation efforts will focus on maintaining species diversity and supporting weak stocks. The Program will also have an associated research element designed to clarify interactions between natural and hatchery fish and quantify the effects supplementation has on natural fish. The final facet of the strategy is to use hatcheries to create fishing opportunities that are benign to listed populations (e.g., terminal area fisheries). For more detail on the use of hatcheries in recovery strategies, please see the Basinwide Salmon Recovery Strategy.

Harvest

Salmon and steelhead have been harvested in the Columbia basin as long as there have been people there. Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) harvest began in the late 1800s and took place primarily in tributary locations (ODFW and WDFW 1998). Steelhead have formed a major component of recreational fisheries for decades. Conservation concerns for natural steelhead have caused regulations to be put in place in Oregon and Washington that strictly limit the number of fish anglers may catch and the types of gear that may be used in many areas.

Initially, the non-Indian fisheries targeted spring and summer chinook salmon, and these runs dominated the commercial harvest during the 1800s. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer chinook salmon exceeded 80 percent (and sometimes 90 percent) of the run—accelerating the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60 percent of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS 1991). Until the spring of 2000—when a relatively large run of hatchery spring chinook salmon returned and provided a small commercial tribal fishery—no commercial season for spring chinook salmon had taken place since 1977. Present Columbia River harvest rates are very low compared with those from the late 1930s through the 1960s (NMFS 1991). Though steelhead—MCR steelhead included—were never as important a component of the Columbia basin's fisheries as chinook, net-based fisheries generally do not discriminate among species, so it can fairly be said that harvest has also contributed to the MCR steelhead declines.

Salmonids' capacity to produce more adults than are needed for spawning offers the potential to sustainably harvest naturally-produced (versus hatchery-produced) fish. This potential can be realized only if two basic management requirements are met: (1) enough adults return to spawn and perpetuate the run, and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events, but as long as the two management requirements are met, NMFS believes that fishing can be sustained indefinitely. Unfortunately, both prerequisites for sustainable harvest have been violated routinely in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

For years, the response to declining catches was hatchery construction to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the naturally-produced (non-hatchery) runs mixed in the same fisheries. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate, and escapement-goal management. As with improvements being made in other phases of the MCR steelhead's life history, it will take some time for these (and future) measures to contribute greatly to the species recovery, but the effort has begun.

Ocean harvest for other species has also affected MCR steelhead—though only incidentally and to an essentially unknown degree. At one point it was estimated that unauthorized high seas drift net fisheries harvested between two percent and 38 percent of the steelhead destined to return to the Pacific Coast of North America (Cooper and Johnson 1992). However, since drift nets were outlawed in 1987, and enforcement has increased, that percentage has certainly decreased greatly. Therefore, while some other fisheries probably affect MCR steelhead, it is indeterminable to what degree—though it is probably a fairly minor one in comparison to the effects arising from other sources.

Natural Conditions

Natural changes in the freshwater and marine environments play a major role in salmonid abundance. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare et al. 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation. In addition, large-scale climatic regime shifts, such as El Niño, appear to change ocean productivity. During the first part of the 1990s, much of the Pacific Coast was subject to a series of very dry years. More recently, severe flooding has adversely affected some stocks (e.g., the low returns of Lewis River bright fall chinook salmon in 1999).

A key factor affecting many West Coast stocks—including MCR steelhead—has been a general 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood, partially because the pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries from subadults relative to the number of CWTs released from that brood year. Time-series of survival rate information for upper Willamette River spring chinook salmon, Lewis River fall chinook salmon, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 2000a).

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although it is not known to what degree. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations—following their protection under the Marine Mammal Protection Act of 1972—has caused a substantial number of salmonid deaths. In recent years, for example, sea lions have learned to target upper Willamette River spring chinook salmon in the fish ladder at Willamette Falls.

Finally, it should be noted that the unusual drought conditions in 2001 warrant additional consideration. The available water in the upper Columbia River basin is 50-60% of normal and will result in some of the lowest flow conditions on record. These conditions will have the greatest effect on upriver stocks, but the MCR will likely feel the effects as well. The juveniles that must pass down river during the 2001 spring and summer out-migration will likely be affected and this, in turn, will affect adult returns primarily in 2003 and 2004, depending on the stock and species. At this time, it is impossible to ascertain what those effects will be, but NMFS is monitoring the situation and will take the drought condition into account in management decisions, including amending take authorizations and other permit conditions as needed.

Scientific Research

MCR steelhead, like other listed fish, are the subject of scientific research and monitoring activities. Most biological opinions NMFS issues recommend specific monitoring, evaluation, and research efforts intended to help gather information that would be used to increase the survival of listed fish. In addition, NMFS has issued numerous research permits authorizing takes of ESA-listed fish over the last few years. Each authorization for take by itself would not lead to decline of the species. However the sum of the authorized takes indicate a high level of research effort in the action area, and as anadromous fish stocks have continued to decline, the proportion of fish handled for research/monitoring purposes has increased. The effect of these activities is difficult to assess because despite the fact that fish are harassed and even killed in the course of scientific research, these activities have a great potential to benefit ESA-listed salmon and steelhead. For example, aside from simply increasing what is known about the listed species and their biological requirements, research is essentially the only way to answer key questions associated with difficult resource issues that crop up in every management arena and involve every salmonid life history stage (particularly the resource issues discussed in the previous sections). Perhaps most importantly, the information gained during research and monitoring activities will help resource managers recover listed species. That is, no rational resource allocation or management decisions can be made without the knowledge to back them up. Further, there is no way to tell if the corrective measures described in the previous sections are working unless they are monitored and no way to design new and better ones if research is not done.

In any case, scientific research and monitoring efforts (unlike the other factors described in the previous sections) are not considered to be a factor contributing to the decline of MCR steelhead, and NMFS believes that the information derived from the research activities is essential to their survival and recovery. Nonetheless, fish *are* harmed during research activities.

And activities that are carried out in a careless or undirected fashion are not likely to benefit the species at all. Therefore, to minimize any harm arising from research activities on the species, NMFS imposes conditions in its permits so that permit holders conduct their activities in such a way as to reduce adverse effects—particularly killing as few salmonids as possible. Also, researchers are encouraged to use non-listed fish species and hatchery fish instead of listed naturally-produced fish when possible. In addition, researchers are required to share fish samples, as well as the results of the scientific research, with other researchers and comanagers in the region as a way to avoid duplicative research efforts and to acquire as much information as possible from the ESA-listed fish sampled. NMFS also works with other agencies to coordinate research and thereby prevent duplication of effort.

In general, for projects that require a section 10(a)(1)(A) permit, applicants provide NMFS with high take estimates to compensate for potential inseason changes in research protocols, accidental catastrophic events, and the annual variability in listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. As a result, the *actual* take in a given year for most research projects, as provided to NMFS in post-season annual reports, is usually less than the authorized level of take in the permits and the related NMFS consultation on the issuance of those permits.

In conclusion, the picture of whether MCR steelhead biological requirements are being met is more clear-cut for habitat-related parameters than it is for population factors: given all the factors for decline—even taking into account the corrective measures being implemented—it is still clear that the MCR steelhead's biological requirements are currently not being met under the environmental baseline. Thus their status is such that there must be a significant improvement in the environmental conditions of their habitat (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a large impact due to the amount of risk the species presently faces under the environmental baseline. In addition, there must be improvements to minimize impacts caused by dams, harvest, hatchery operations, habitat degradation, and unfavorable natural conditions.

EFFECTS OF THE ACTION

The purpose of this section is to identify what effects NMFS' issuance of scientific research permits will have on threatened MCR steelhead. To the extent possible, this will include analyzing effects at the population level. Where information on MCR steelhead is lacking at the population level, this analysis assumes that the status of each affected population is the same as the ESU as a whole. The method NMFS uses for evaluating effects is discussed first, followed by discussions of the general effects scientific research activities are known to have and permit-specific effects.

Evaluating the Effects of the Action

Over the course of the last decade and hundreds of ESA section 7 consultations, NMFS developed the following four-step approach for applying the ESA Section 7(a)(2) standards when determining what effect a proposed action is likely to have on a given listed species. What follows here is a summary of that approach; for more detail please see *The Habitat Approach: Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Salmonids* (NMFS 1999).

1. Define the biological requirements and current status of each listed species.

2. Evaluate the relevance of the environmental baseline to the species' current status.

3. Determine the effects of the proposed or continuing action on listed species and their critical habitat.

4. Determine whether the species can be expected to survive with an adequate potential for recovery under (a) the effects of the proposed (or continuing) action, (b) the effects of the environmental baseline, and (c) any cumulative effects—including all measures being taken to improve salmonid survival and recovery.

The fourth step above requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (i.e., impacts on essential habitat features). The second part focuses on the species itself. It describes the action's impact on individual fish—or populations, or both—and places that impact in the context of the ESU as a whole. Ultimately, the analysis seeks to answer the questions of whether the proposed action is likely to jeopardize a listed species' continued existence or destroy or adversely modify its critical habitat.

Effects on Critical Habitat

Previous sections have detailed the circumstances surrounding the designation of MCR steelhead critical habitat, described the essential features of that habitat, and depicted its present condition. The discussion here focuses on how those features are likely to be affected by the proposed actions.

Full descriptions of the proposed activities are found in the next section. In general, the activities will be (a) electrofishing—using both backpack- and boat-based equipment, (b) streamside and snorkel surveys in spawning and rearing habitat, (c) smolt trapping at dams, and (d) capturing fish with angling equipment, traps, and nets of various types. All of these techniques are minimally intrusive in terms of their effect on habitat. None of them will measurably affect any of the 10 essential fish habitat features listed earlier (i.e., stream substrates, water quality, water quantity, food, streamside vegetation, etc.). Moreover, the proposed activities are all of short duration. Therefore, NMFS concludes that the proposed activities are unlikely to adversely modify critical habitat.

Effects on MCR Steelhead

The primary effects the proposed activities will have on MCR steelhead will occur in the form of direct "take" (the ESA take definition is given in the section introducing the individual permits) a major portion of which takes the form of harassment. Harassment generally leads to stress and other sub-lethal effects and is caused by observing, capturing, and handling fish. The ESA does not define harassment nor has NMFS defined this term through regulation. However, the USFWS defines harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.4]. For the purposes of this analysis, NMFS adopts this definition of harassment.

As Table 1 illustrates, the various proposed activities would cause many types of take, and while there is some blurring of the lines between what constitutes an activity (e.g., electrofishing) and what constitutes a take category (e.g., harm), it is important to keep the two concepts separate. The reason for is this is that the effects being measured here are those which the activity itself has on the listed species. They may be expressed in *terms* of the take categories (e.g., how many MCR steelhead are harmed, or harassed, or even killed), but the actual mechanisms of the effects themselves (i.e., the activities) are the causes of whatever take arises and, as such, they bear examination. Therefore, the first part of this section is devoted to a discussion of the general effects known to be caused by the proposed activities—regardless of where they occur or what species are involved.

The following subsections describe the types of activities being proposed. Because they would all be carried out by trained professionals using established protocols and have widely recognized specific impacts, each activity is described in terms broad enough to apply to every proposed permit. This is especially true in light of the fact that the researchers would not receive a permit unless their activities (e.g., electrofishing) incorporate NMFS' uniform, pre-established set of mitigation measures. These measures are described on page 6 of this Opinion. They are incorporated (where relevant) into every permit as part of the terms and conditions to which a researcher must adhere.

Observation

For some studies, ESA-listed fish will be observed in-water (i.e., snorkel surveys). Direct observation is the least disruptive method for determining presence/absence of the species and estimating their relative abundance. Its effects are also generally the shortest-lived among any of the research activities discussed in this section. Typically, a cautious observer can effectively obtain data without disrupting the normal behavior of a fish. Fry and juveniles frightened by the turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize the amount of disturbance by moving through streams slowly—thus allowing ample time for fish to reach escape cover; though it should be noted that the research may at times involve observing adult fish—which are more sensitive to disturbance. During some of the research activities discussed below, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur—particularly in cases where the observation is to be conducted solely by researchers on the stream banks rather than in the water. There is little a researcher can do to mitigate the effects associated with observation activities because those effects are so minimal. In general, all they can do is move with care and attempt to avoid disturbing sediments, gravels, and, to the extent possible, the fish themselves.

Capture/handling

Capturing and handling fish causes them stress—though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived. The primary contributing factors to stress and death from handling are excessive doses of anesthetic, differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis.

Based on prior experience with the research techniques and protocols that would be used to conduct the proposed scientific research, no more than five percent of the juvenile salmonids encountered are likely to be killed as an indirect result of being captured and handled and, in most cases, that figure will not exceed three percent. In addition, it is not expected that more than one percent of the adults being handled will die. In any case, all researchers will employ the mitigation measures described earlier (page 6) and thereby keep adverse effects to a minimum. Finally, any fish indirectly killed by the research activities in the proposed permits may be retained as reference specimens or used for analytical research purposes.

Electrofishing

Electrofishing is a process by which an electrical current is passed through water containing fish in order to stun them—thus making them easier to capture. It can cause a suite of effects ranging form simple harassment to actually killing the fish (adults and juveniles) in an area where it is occurring. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Electrofishing can have severe effects on adult salmonids. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing killed 50 percent of the adult rainbow trout in their study. The long-term effects electrofishing has on both juvenile and adult salmonids are not well understood, but long experience with electrofishing indicates that most impacts occur at the time of sampling and are of relatively short duration.

The effects electrofishing will have on MCR steelhead would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river (see the next subsection for more detail on capturing and handling effects). Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey et al. 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline 1994, Dalbey et al. 1996, Thompson et al. 1997). McMichael et al. (1998) found a 5.1% injury rate for juvenile MCR steelhead captured by electrofishing in the Yakima River subbasin. The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, McMichael 1993, Dalbey et al. 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency (≤30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992, 1995, Dalbey et al. 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992, McMichael 1993, Sharber et al. 1994, Dalbey et al. 1996). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie et al. 1998, Dalbey et al. 1996). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes they show no growth at all (Dalbey et al. 1996).

NMFS' electrofishing guidelines (NMFS 2000d) will be followed in all surveys requiring this procedure. The guidelines require that field crews be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish before electrofishing may begin. Electrofishing is not done in the vicinity of redds or spawning adults. All electrofishing equipment operators are trained by qualified personnel to be familiar with equipment handling, settings, maintenance, and safety. Operators work in pairs to increase both the number of fish that may be seen and the ability to identify individual fish without having to net them. Working in pairs also allows the researcher to net fish before they are subjected to higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels and water conductivity will be tested at the start of every electrofishing session so those minimal levels can be determined. Due to the low settings used, shocked fish normally revive instantaneously. Fish requiring revivification will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers electrofishing units are sometimes mounted on boats. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit researchers' ability to minimize impacts on fish. For example, in areas of lower visibility it is difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NMFS has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NMFS' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. And in any case, all researchers intending to use boat electrofishing will use all means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated int NMFS' guidelines).

Tagging/marking

Techniques such as PIT-tagging (passive integrated transponder tagging), coded wire tagging, fin-clipping, and the use of radio transmitters are common to many scientific research efforts using ESA-listed species. All sampling, handling, and tagging procedures have an inherent potential to stress, injure, or even kill the marked fish. This section discusses each of the marking processes and its associated risks.

A PIT tag is an electronic device that relays signals to a radio receiver; it allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without researchers having to handle the fish again. The tag is inserted into the body cavity of the fish just in front of the pelvic girdle. The tagging procedure requires that the fish be captured and extensively handled, therefore any researchers engaged in such activities will follow the conditions listed on page 6 of this Opinion (as well as any permit-specific terms and conditions) to ensure that the operations take place in the safest possible manner. In general, the tagging operations will take place where there is cold water of high quality, a carefully controlled environment for administering anesthesia, sanitary conditions, quality control checking, and a carefully regulated holding environment where the fish can be allowed to recover from the operation.

PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice et al. 1987; Jenkins and Smith 1990; Prentice et al. 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 km), Hockersmith et al. (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically implanted sham radio tags or PIT-tags. Additional studies have shown that growth rates among PIT-tagged Snake River juvenile fall chinook salmon in 1992 (Rondorf and Miller 1994) were similar to growth rates for salmon that were not tagged (Conner et al. 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.

Coded wire tags (CWTs) are made of magnetized, stainless-steel wire. They bear distinctive notches that can be coded for such data as species, brood year, hatchery of origin, and so forth (Nielsen 1992). The tags are intended to remain within the animal indefinitely, consequently making them ideal for making long-term, population-level assessments of Pacific Northwest salmon. The tag is injected into the nasal cartilage of a salmon and therefore causes little direct tissue damage (Bergman et al. 1968; Bordner et al. 1990). The conditions under which CWTs may be inserted are similar to those required for applying PIT-tags.

A major advantage to using CWTs is the fact that they have a negligible effect on the biological condition or response of tagged salmon; however if the tag is placed too deeply in the snout of a fish, it may kill the fish, reduce its growth, or damage olfactory tissue (Fletcher et al. 1987; Peltz and Miller 1990). This latter effect can create problems for species like salmon because they use olfactory clues to guide their spawning migrations (Morrison and Zajac 1987).

In order for researchers to be able to determine later (after the initial tagging) which fish possess CWTs, it is necessary to mark the fish externally—usually by clipping the adipose fin—when the CWT is implanted (see text below for information on fin clipping). One major disadvantage to recovering data from CWTs is that the fish must be killed in order for the tag to be removed. However, this is not a significant problem because researchers generally recover CWTs from salmon that have been taken during the course of commercial and recreational harvest (and are therefore already dead).

The other primary method for tagging fish is to implant them with radio tags. There are two main ways to accomplish this and they differ in both their characteristics and consequences.

First, a tag can be inserted into a fish's stomach by pushing it past the esophagus with a plunger. Stomach insertion does not cause a wound and does not interfere with swimming. This technique is benign when salmon are in the portion of their spawning migrations during which they do not feed (Nielsen, 1992). In addition, for short-term studies, stomach tags allow faster post-tagging recovery and interfere less with normal behavior than do tags attached in other ways.

The second method for implanting radio tags is to place them within the body cavities of (usually juvenile) salmonids. These tags do not interfere with feeding or movement. However, the tagging procedure is difficult, requiring considerable experience and care (Nielsen 1992). Because the tag is placed within the body cavity, it is possible to injure a fish's internal organs. Infections of the sutured incision and the body cavity itself are also possible, especially if the tag and incision are not treated with antibiotics (Chisholm and Hubert 1985, Mellas and Haynes 1985).

Fish with internal radio tags often die at higher rates than fish tagged by other means because radio tagging is a complicated and stressful process. Mortality is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment). Acute mortality is caused by trauma induced during capture, tagging, and release. It can be reduced by handling fish as gently as possible. Delayed mortality occurs if the tag or the tagging procedure harms the animal in direct or subtle ways. Tags may cause wounds that do not heal properly, may make swimming more difficult, or may make tagged animals more vulnerable to predation (Howe and Hoyt 1982, Matthews and Reavis 1990, Moring 1990). Tagging may also reduce fish growth by increasing the energetic costs of swimming and maintaining balance. As with the other forms of tagging and marking, researchers will keep the harm caused by radio tagging to a minimum by following the conditions given on page 6 of this Opinion, as well as any other permit-specific requirements.

Fin clipping is the process of removing part or all of one or more fins to alter a fish's appearance and thus make it identifiable. When entire fins are removed, it is expected that they will never grow back. Alternatively, a permanent mark can be made when only a part of the fin is removed or the end of a fin or a few fin rays are clipped. Although researchers have used all fins for marking at one time or another, the current preference is to clip the adipose, pelvic, or pectoral fins. Marks can also be made by punching holes or cutting notches in fins, severing individual fin rays (Welch and Mills 1981), or removing single prominent fin rays (Kohlhorst 1979). Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat variable; however, it can be said that fin clips do not generally alter fish growth. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., Brynildson and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly—especially those caused by partial clips.

Mortality among fin-clipped fish is also variable. Some immediate mortality may occur during the marking process, especially if fish have been handled extensively for other purposes (e.g., stomach sampling). Delayed mortality depends, at least in part, on fish size; small fishes have often been found to be susceptible to it and Coble (1967) suggested that fish shorter than 90 mm are at particular risk. The degree of mortality among individual fishes also depends on which fin is clipped. Studies show that adipose- and pelvic-fin-clipped coho salmon fingerlings have a 100% recovery rate (Stolte 1973). Recovery rates for steelhead were 60% when the adipose fin was clipped and 52% when the pelvic fin was clipped and dropped markedly when the pectoral, dorsal, and anal fins were clipped (Nicola and Cordone 1973). Clipping the adipose and pelvic fins probably kills fewer fish because these fins are not as important as other fins for movement or balance (McNeil and Crossman 1979). Mortality is generally higher when the major median and pectoral fins are clipped. Mears and Hatch (1976) showed that clipping more than one fin may increase delayed mortality, but other studies have been less conclusive.

Regardless, any time researchers clip or remove fins, it is necessary that the fish be handled. Therefore, the same safe and sanitary conditions required for tagging operations also apply to clipping activities.

Sacrifice

In some instances, it is necessary to kill a captured fish in order to gather whatever data a study is designed to produce. In such cases, determining effect is a very straightforward process: the sacrificed fish, if juveniles, are forever removed from the ESU's gene pool; if the fish are adults, the effect depends upon whether they are killed before or after they have a chance to spawn. If they are killed after they spawn, there is very little overall effect. Essentially, it amounts to removing the nutrients their bodies would have provided to the spawning grounds. If they are killed before they spawn, not only are they removed from the ESU, but so are all their potential progeny. Thus, killing pre-spawning adults has the greatest potential to affect their ESU and, because of this, NMFS rarely allows it to happen. And, in almost every instance where it is allowed, the adults are stripped of sperm and eggs so their progeny can be raised in a controlled environment such as a hatchery—thereby greatly decreasing the potential harm posed by sacrificing the adults. Clearly, there is no way to mitigate the effects of outrightly sacrificing a fish.

Permit-specific Effects

Permit 1056—Modification 3

The modification to Permit 1056 would authorize the NWFSC to use electrofishing, seining, dip-netting, minnow trapping, and angling to capture up to 500 juvenile MCR steelhead in the John

Day River subbasin. Two hundred of those fish would be sacrificed, and the permit would allow ten more to be killed as an indirect result of the capturing and handling process. The other (approximately) 300 juveniles would be captured, handled, and released. The sites where the fish are to be taken will be chosen with the help of local, state, and tribal biologists, and in no instance will more than 20 juveniles be taken for sacrifice from a single site. Therefore, the take will be distributed over at least 10 sites throughout the John Day subbasin—thus ensuring that no single breeding population has to bear the removal of more than a few individuals.

Though there are no data for how many juvenile steelhead will be produced in the John Day River system in 2001, NMFS estimates (Schiewe 2001) that 228,114 juveniles will enter the Columbia River between McNary and John Day Dams. The only other steelhead-producing tributary of consequence in this area is the Umatilla River, and whatever its numbers, it produces fewer fish than the vastly larger John Day System. Thus the 200 fish that would be sacrificed in the research will come out of a total of well over 100,000 fish—that is, they will constitute far less than 0.2 percent of the portion of the ESU that migrates down the John Day River. (The 100,000 figure is arbitrarily conservative given that the John Day probably produces a great deal more than half of the 228,114 juveniles mentioned above.) The long-term impact of this loss is so small as to be essentially inestimable, particularly when placed in context of the ESU as a whole, which is expected to produce a total of 379,264 outmigrants that reach The Dalles Dam in 2001 (Schiewe 2001). In addition, an unknown number more will be produced in the Klickitat, White Salmon, and Hood Rivers. In which case, the loss that would be caused by issuing Permit 1056 is something less than 0.05 percent.

The permit would also authorize the NWFSC to perform snorkel surveys to determine steelhead abundance at each of the (up to) 10 sites where sampling will be performed. Moreover, the permit will allow the NWFSC to share collected tissue samples with the Shoshone-Bannock Tribe (SBT), other members of the NWFSC, and the Idaho Department of Fish and Game (IDFG). If adult carcasses are encountered, the researchers would share tissues from them with the SBT, the IDFG, and the Nez Perce Tribe.

The effects of the non-lethal take would be mitigated by the various means discussed earlier. The researchers would use a great deal of care to ensure that the captured fish that are not sacrificed are returned to the river safely. The estimate that 10 fish would be indirectly killed by the operations is a conservative one based on many years of expertise in determining the effects of capturing and handling juvenile salmonids. There is, of course, no way to mitigate the effects resulting from purposely sacrificing 200 juveniles. It is NMFS position, however, that those effects can be offset by the knowledge to be gained form the research—knowledge that will be used to improve the species' future prospects.

<u>Permit 1140—Modification 1</u>

Permit 1140 would authorize the NWFSC to capture, handle, and release up to two MCR steelhead juveniles. The permit would also allow one of those fish to be killed as an indirect result of being captured and handled. There is no way of determining which portion of the ESU these fish might come from. Because the study targets fall chinook—capturing them with nets in the Columbia River estuary—it is unlikely that *any* MCR steelhead will be present at the time the research is being conducted. And even if they were, all fish from the ESU eventually pass the estuary; therefore, determining their exact population of origin is an impossibility. It should be noted that the numbers "two captured and one dead" are higher than the researchers have found in past efforts in the same area, and are therefore overestimates included for safety and completeness' sake.

In general, the study is designed in such a way that it is unlikely to have any effect on MCR steelhead at all: the research simply targets other species that have different migration timings. Even if the maximum estimated number of MCR steelhead were taken, the numbers are so small (two out of more than 379,000—or less than 0.0005%) that it would be impossible to gauge the effect on any single population, let alone the ESU as a whole. Nonetheless, the researchers will use all due care (and the previously described mitigation measures) to ensure that any captured MCR steelhead are safely returned to the estuary.

<ins>Permit 1156—Modification 1</ins>

Permit 1156 would authorize Dynamac Corporation—a contractor for the EPA—to use backpack electrofishing (in Shellneck and Nelson Creeks in Washington) and boat electrofishing (in the Deschutes and John Day Rivers in Oregon) to capture and handle up to 35 MCR steelhead juveniles and up to 12 MCR steelhead adults. Only one juvenile MCR steelhead may be killed during these operations (representing less than 0.0003% of the ESU). Should any adults be encountered, they will not be handled in any way—merely counted. Any juveniles encountered will be examined and released as soon as they have recovered from effects of being captured. They will not be tissue-sampled or marked, and would be used simply to help determine the species present (and their proportionate abundances) at the sample site.

It should be noted that the take numbers above are conservative estimates. For the Washington State portion of the activities, Nelson and Shellneck Creeks are both first-order streams—meaning that they are small and intermittent and therefore could not support many steelhead—and previous surveys in the area have failed to find MCR steelhead that far up in their respective watersheds (WDF et al. 1993). Thus it is unlikely that the researchers will encounter any MCR steelhead at all in either of those creeks. In the John Day River, most juveniles will have moved out of the system by the time the electrofishing starts. The adults will largely be holding in the lower portions of tributaries during the summer and staying out of the mainstem areas where the electrofishing will take place. The same is true in the Deschutes River.

Moreover, the researchers will use ODFW and WDFW district biologist input to reduce encounters with listed species. To minimize electrofishing injury, the researchers will use a low pulse rate (30 pulses/s), a narrow pulse width (< 6msec), low peak voltage (500 V). These settings are much less harmful to larger fish and, though they are not as effective for collecting small fish, they do stimulate benthic species to move up in the water column where they are more easily netted. For the raft-mounted gear, the researchers will employ large cathodes (20 droppers) and 6 anode droppers to reduce the field strength in the vicinity of the electrodes and to allow the use of lower voltages. Stunned fish are recovered using a soft mesh dipnet and placed in a holding tank. Following the collection of biological information, the fish are placed back in the holding tank to recover before being released alive. If juvenile salmonids are harmed, the researchers will increase the pulse rate (which decreases the potential damage to small fish but increases the potential threat to larger fish). If large and small salmonids are present and the small ones show evidence of harm, the researchers will shorten the holding time in the live well. All operators of electrofishing equipment will be fully trained.

Permit 1229—Modification

Permit 1229 would authorize the Wasco County PUD to take up to six MCR steelhead juveniles during their sampling operations at The Dalles Dam. Only one fish would be allowed to be killed during these operations. The fish will be intercepted in the screened discharge from the turbine intake channel, diverted into an overflow tank, examined for condition, and allowed to return to the river via a bypass channel immediately after they recover from the effects of the MS-222 anesthetic that will be used to keep them calm during the sampling process.

Because the fish constitute a random sample of all the fish coming down the river, there is no way to know their population of origin. The only major producer of MCR steelhead below The Dalles Dam is the Klickitat River, so all that can be said is that the fish will originate somewhere else in the ESU. This means that six fish out of approximately 379,000 will be captured and handled under the permit—and only one of those may be killed. It should be noted that the number six is based on a scenario under which every possible smolt from the upper basin will be captured at the dams and transported to a point below Bonneville Dam ("full transportation"). The FCRPS is operating under a full transportation scenario in 2001.

The potential to injure or kill the sampled fish in this instance is very low because the process is minimally intrusive, the fish are simply examined, and they are allowed to return to the river after a very short time. (Recovery from dilute MS-222 requires one to five minutes.) In previous years, the overall injury and mortality rates at the facility for all salmonids captured were 2.5% and 0.05%, respectively (Wasco PUD permit application). This, combined with the fact that a maximum of only six (out of approximately 379,000) MCR steelhead are to be taken, signifies that the permitted activity's effects on the species are so slight as to be unmeasurable because the likelihood is that not even one fish will be injured—let alone killed.

Permit 1252

Permit 1252 would authorize the WDOT to observe (harass) and capture and handle up to 10 juvenile MCR steelhead during the course of conducting presence/absence surveys in waters near proposed WDOT projects on state highways. Of the 10 MCR steelhead that may possibly be captured and handled, a maximum of one may die. The WDOT will use the following methods to determine if MCR steelhead are present in any of their project areas: snorkel surveys, dip nets, seines, baited minnow traps, and rod and reel. The WDOT does not anticipate using electrofishing equipment anywhere in the Columbia River basin. In all cases, the fish will be held for as short a time as possible (no more than 30 minutes and generally less than three) before they are identified, counted, and returned to the river.

The 10 fish that may be captured will be at widely dispersed locations: projects that may capture MCR steelhead are planned in the Klickitat, Walla Walla, and Yakima River subbasins and along the mainstem of the Columbia River. It is impossible to determine how many fish (of the 10) will come from the individual projects, because the projects are only *planned* at this stage and it is not certain that they will actually be implemented. In addition, it is not known how many fish migrate down the Klickitat and Walla Walla Rivers. Therefore, the activities taking place under the permit would capture 10 and kill (possibly) one MCR steelhead out of more than 379,000 fish. The adverse effects of this take are negligible.

Nonetheless, the WDOT will minimize any adverse effects from the research by: (a) adapting the survey method to the size of the system to be surveyed; (b) sampling for short periods only—with the exception of baited minnow traps—and targeting pools and riffles; (c) keeping fish in the water unless it is absolutely necessary to remove them; and (d) checking baited minnow traps daily. Though the WDOT does not plan to use electrofishing in waters inhabited by MCR steelhead, if it *is* used it will not take place in waters where water temperatures are very high or very low and it will not be conducted when samplers cannot see the stream bottom in one foot of water. And in all cases, NMFS' electrofishing guidelines will be followed.

Permit 1290

Permit 1290 would allow the NWFSC—while conducting purse seining in the Columbia River estuary—to capture, handle, and release up to 12 juvenile MCR steelhead. The permit would also allow one of those fish to be killed as an indirect result of being captured and handled. Because the study targets baitfish in the estuary, and because the seining will occur approximately every 12 days from April through September, it is likely that few, if any, MCR steelhead will be encountered. Steelhead generally migrate downstream in the spring and early summer (Emmett, et al. 1991), and therefore half to most of the seining will occur after they have left the area.

In addition, even if the researchers do capture MCR steelhead, it would be impossible to determine their origin within the ESU. All fish from this ESU pass through the estuary over the course of the late spring and early summer months and they mix freely while doing so. Therefore, there is no way to tie the effects of the research to a specific population. Moreover, the number being captured is so small (and, at most, only one juvenile would be killed) that even if their population of origin could be determined, the research would have no more than negligible negative effect. This is doubly true for measuring the effect the captures would have on the ESU as a whole. Nonetheless, the researchers will use all due care (and the previously described mitigation measures) to ensure that any captured MCR steelhead are returned to the estuary safely.

Permit 1291

Permit 1291 would allow the USGS—in one study—to capture, handle, and release MCR steelhead and, in another, to capture, handle, tag, transport, and release them. The studies are planned to take place at John Day Dam, but Bonneville Dam will be used if the researchers cannot collect enough fish at John Day Dam. The two studies are termed "The Fish Collection Request," and the "Handle, Tag, and Release Wild Juvenile Steelhead Request." In the Fish Collection Request study, the researchers would capture, handle, and release a (maximum) total of 3,936 juvenile MCR steelhead. The permit would allow a maximum of 79 of these fish to be killed as an indirect result of the research. Further, the permit would allow 394 juvenile MCR steelhead to be captured, handled, tagged, transported, and released under the "Handle, Tag, and Release Wild Juvenile Steelhead Request." The researchers would be permitted to kill eight of these fish as an indirect result of the research.

The two studies will operate in conjunction; all the fish will be captured in the smolt bypass facilities of either John Day or Bonneville Dam. The fish captured for the tagging study will be tagged with radio transmitters and transported up- or downstream and released; the rest will be allowed to recover from the MS-222 anesthetic (used when sorting captured juvenile salmonids by species) and returned immediately to the river. The mortality level for both studies is estimated to be two percent. This is a conservative estimate based on (a) past experience capturing, handling, and tagging fish at these facilities; (b) the fact that a number of studies (e.g., Hockersmith et al. (2000)) have concluded that the performance of yearling chinook salmon is not adversely affected by gastrically- or surgically implanted sham radio tags; and (c) previous USGS studies showing that more than 99% of fish that have been implanted with radio tags survive for (at least) 21 days of observation.

In any case, the numbers of MCR steelhead juveniles that may—at an absolute maximum—be killed in the Fish Collection Request and the Handle, Tag, and Release Request (79, and eight, respectively) constitute a small enough fraction of the run that the effect is difficult to measure at all. Because the fish will be taken from a random sample of the MCR steelhead arriving at John

Day and (possibly) Bonneville Dams, there is no way to determine their populations of origin. All that can be said is that the fish taken at Bonneville may include Deschutes, Klickitat, White Salmon, and Hood River steelhead while the sample at John Day cannot. Therefore, the number that may be killed (87) would constitute some 0.03% of the 297,547 fish expected to arrive at John Day Dam (Schiewe 2001), and 0.02% of the 379,264 (at a minimum) fish expected to arrive at Bonneville Dam (Schiewe 2001). The latter number is described as a minimum because it is actually an estimate of the number of fish expected to arrive at The Dalles Dam. There is no express estimate for the number of fish expected at Bonneville, but whatever the number is, it will certainly be larger than the number expected at The Dalles.

Nonetheless, even though the percentage of the run that is likely to be killed by this research is extremely small, the USGS will implement the following measures to minimize impacts on MCR steelhead being handled and tagged: (1) Fish with PIT tags will not be tagged with radio transmitters. (2) As fish are moved through the tanks at the dams, they will be examined thoroughly to ensure that they are not being harmed by tank hardware. (3) The fish will be anesthetized and sorted as quickly as possible in small batches to ensure that they are not exposed to anesthesia for unnecessarily long periods of time. (4) The transmitters will be implanted as quickly and safely as possible—while always taking the condition of the fish into account. (5) The USGS will use an artificial slime restorer and a buffer when fish are anesthetized. (6) They will administer antibiotics intraperitoneally and disinfect all surgical instruments to protect the fish from infection. (7) They will adapt the implantation technique to the size and condition of the fish to minimize the stress associated with tagging. (8) The fish will only be netted when necessary and only with sanctuary nets. (9) Oxygen and high-flow water will be provided to help fish recover from the tagging procedures. (10) The holding tanks will be supplied with de-gassing columns to keep nitrogen saturation levels down.

Moreover, because some "minimal" portion of the tagged fish are to be transported—by truck or boat or both—the USGS will also take the following precautions during that portion of the operation: (1) The fish will be held in 125-liter containers at low densities (four to five fish per container); (2) transit times will only be 20-30 minutes long (though bad weather may slow boat transport to the release spot); and (3) the temperature in the containers will be maintained within one degree of ambient river temperature by the addition of either chlorine-free ice or fresh river water.

NMFS believes all these measures—together with the standard mitigation measures mentioned earlier—will adequately minimize any adverse impacts arising from the capturing, handling, tagging, and transportation processes. This, coupled with the extremely small percentage of fish expected to be killed in even a worst-case scenario, indicates that the research will have no more than a negligible adverse effect on the ESU.

<u>Permit 1292</u>

Permit 1292 would allow the USFS to capture and take tissue samples from up to 23 juvenile MCR steelhead. The permit would also allow one fish to die as an indirect result of being captured and sampled. The fish would be captured by angling using flies with barbless hooks. Once they are caught they would be anesthetized with CO_2 and 10-milligram tissue samples would be taken from their caudal fins. After that, they would be allowed to recover from the anesthetic and returned to the stream.

The sampling would be done in Quartz and S. Fork Quartz Creeks and the Naches River—all in the Yakima River subbasin. It is estimated that 69,433 MCR steelhead will migrate out of the Yakima subbasin in 2001 (Schiewe 2001). Therefore, the researchers would capture less than 0.03% of the run from that population and kill—at most—0.001%. And even that figure is somewhat high. The estimated one dead fish is a result of rounding percentages up. Hooking mortality (with barbless hooks) is estimated to be around 4% of the total number of fish captured (Schill et al. 1986), which means—given a sample of 23 juvenile MCR steelhead—that not even one fish is likely to die as a result of the research.

Thus the number of fish likely to be captured or killed in the course of this research is so small that it is impossible to determine that it will have any adverse effect on the Yakima River population—let alone the ESU as a whole. Nonetheless, the researchers will work diligently to return the fish to the river as rapidly as possible and will take all due care to see that the fish they capture are not harmed during the process.

Permit 1293

Permit 1293 would allow the NRC to observe and harass—using electrofishing and visual observation techniques—up to 28 MCR steelhead. The permit would also allow one of those fish to be killed as a result of the operation. The fish would be observed in the headwater areas of as many as eight counties in Washington and Oregon (Klickitat, Skamania, Columbia, Clatsop, Clark, Wahkiakum, Cowlitz, and Pacific). Because the purpose of the study is to determine where resident cutthroat trout are present in small upland streams in portions of these counties, no MCR steelhead would be captured or handled. They would simply be observed, their species would be noted, and they would be harassed no further.

Because it is difficult to precisely determine where the take will be occurring under this permit—NRC does contract work for a number of small woodlot owners and the locations of the surveys shift yearly—the effects of the take cannot be tied to a discrete population. But in any case only one MCR juvenile, at most, will be killed during the course of the research. This loss will have a negligible effect on the MCR steelhead ESU as a whole.

Moreover, NRC will implement the following measures, which NMFS believes will adequately minimize impacts in on the MCR steelhead. (1) If the riparian habitat is open and the stream is readily accessible or a cutthroat trout can be identified visually, electrofishing will not even be used. (2) If it *is* used, no listed fish will be handled. (3) NRC will follow NMFS' backpack electrofishing guidelines (NMFS 2000). (4) NRC will employ trained staff who possess knowledge about and experience with electrofishing equipment and have a proven record of using the gear without injuring fish.

Permit 1317

Permit 1317 would allow the USGS to capture and mark up to 500 MCR steelhead in the Toppenish wildlife refuge, Washington. The permit would also allow up to 25 steelhead to be killed during the course of the research. The primary method of capturing the steelhead would involve the use of baited minnow traps. The captured fish would be anesthetized, marked using a panjet (a device that uses high pressure to transfer dyes into the external tissues of an animal), and released. The USGS may use fyke nets or electrofishing if the baited minnow traps fail to catch enough steelhead for the research, however this is not considered likely.

Because the research will all take place in a limited area in the Yakima River subbasin, the context for the effect is the 69,433 juvenile MCR steelhead that system is expected to produce (Schiewe 2001). The death of, at most, 25 juvenile MCR steelhead (5% of the sample captured) would mean a 0.04% reduction in the Yakima River population. And the number would only be that high if electroshocking is used (unlikely) or other unforseen circumstances occur (e.g., delayed mortality as a result of injury). In similar previous studies, the USGS has found a total mortality rate of 1-2%—as opposed to the 5% rate being used here. Therefore, it is likely that even fewer than 0.04% of the Yakima River steelhead outmigration will be killed during this research—perhaps as little as 0.02% or less. The effect of this loss on the Yakima River population would be negligible. This is especially true when the loss is placed in the context of the entire ESU's outmigration.

Even though the adverse effects of the research are exceedingly small, the USGS will work to minimize them even further. Aside from the mitigation measures mentioned earlier, they will constantly monitor their sampling methods and results and ensure that MCR steelhead injuries are kept to a minimum. In addition, if they find MCR steelhead juveniles in areas with lethal conditions (e.g., stranded in an area with high water temperatures), they will move the fish to a safer location.

Permit 1318

Permit 1318 would allow the ODFW to capture, handle, and release up to 20 juvenile and up to five adult MCR steelhead during boat electrofishing operations on the Deschutes River in Oregon. The permit would also allow up to one of the juveniles to be killed during the operation. The ODFW would conduct the research in four sample reaches between river miles 34 and 87 on the mainstem of the Deschutes River. The juvenile MCR would be captured using soft mesh dip nets, identified by species, allowed to recover in a livewell on the electrofishing boat, and released. No adults would be captured.

Approximately 81,717 juvenile MCR steelhead are expected to reach the Columbia River between The Dalles and John Day Dams (Schiewe 2001). Almost all of these fish will be produced in the Deschutes River. The potential loss of one juvenile therefore represents some 0.0012% of the expected run from that population. In reality, that percentage is probably even lower. First, the figure represents a 5% mortality rate among the fish being captured—about the same as the rate (5.1%) McMichael et al. (1998) found for *injuries* among juvenile MCR steelhead captured by electrofishing in the Yakima River subbasin. Second, because the research will occur from February to mid-March, no steelhead juveniles may be encountered at all. (They usually hold in tributary areas until mid- to late March when they begin their downstream migration.) Further, it is likely that not even five adults will be encountered because the Deschutes River population is made up of summer-run fish that will have long since finished spawning (and therefore, dying) by the time the electrofishing occurs. However, it is possible that a very few winter-run fish or iteroparous survivors of the previous year's spawning run may be present during the electrofishing operation; therefore, the number of adults that may be encountered is conservatively set at five. In any case, none will be captured, and the electrofishing equipment will be turned off at the first sight of any adult MCR steelhead—thereby allowing them to readily escape the boat's electric field.

Even though the adverse effects associated with the research are very small—even negligible—the ODFW will work to minimize them even further. Aside from the mitigation measures mentioned earlier, they will adhere as much as possible to NMFS' backpack electrofishing guidelines, will use soft-mesh dip nets to remove any salmonids from the electric field as rapidly as possible, and will allow any captured MCR steelhead to recover in a livewell before releasing them back into the river. In addition, they will closely monitor all captured fish to help determine the ideal equipment settings to avoid injuring salmonids—both during the course of the research and in future efforts.

Permit 1321

Permit 1321 would allow Mr. Kenneth Witty to capture—using a backpack electrofishing unit—handle, and release up to 200 juvenile MCR steelhead. The permit would also allow Mr. Witty to employ a screw trap to capture, handle, mark, and release a another 200 juvenile MCR steelhead. The permit would allow up to 20 of those fish (10 for each capture method) to be killed as an indirect result of the research. The research would take place in series of network drains and wasteways designed to convey irrigation return flows back to the Yakima River. The screw trap would be installed in Sulphur Creek and the electrofishing would occur in a number of places throughout the system in the lower Yakima subbasin. Fish captured by electrofishing would be allowed to recover in buckets containing aerated water and returned to the stream at the point where they were taken. Fish caught in the screw trap would have their caudal fins injected with a small amount of photonic spray dye (which will disappear over the course of several months), be transported upstream approximately one-half mile from the point where they were captured, and released.

Because the research will all take place in a limited area in the Yakima River subbasin, the context for the effect is the 69,433 juvenile MCR steelhead that system is expected to produce (Schiewe 2001). The death of, at most, 20 juvenile MCR steelhead (5% of the total sample captured) would mean a 0.03% reduction in the Yakima River population. And the number could only reach that high if electroshocking were used to capture all the fish in the study—when in fact, it will be used to capture only half the MCR steelhead that may be encountered. The overall 5% mortality rate is also ascribed to the screw trap operation for the sake of erring on the conservative side. Moreover, because the study does not specifically target MCR steelhead, and because previous surveys in the drainage network have found far fewer than 400 steelhead (in the year 2000, Mr. Witty found seven MCR steelhead in a survey of 1.3 miles of the network), it is likely that even fewer than 0.03% of the Yakima River steelhead outmigration will be killed during this research. The effect of this loss on the Yakima River population is so small as to be essentially unmeasurable. This is especially true when the loss is placed in the context of the entire ESU's outmigration.

Even though the adverse effects associated with the research are very small, Mr. Witty will work to minimize them even further. Aside from the mitigation measures mentioned earlier, Mr. Witty's team will adhere to NMFS' backpack electrofishing guidelines, discontinue the use of the screw traps if temperatures elevate to the point where they can be hazardous to juvenile steelhead, and will reassess the use of the trap if fish are caught at any time other than mid-March through early June. Moreover, the fish to be transported will be carried in plastic tubs containing aerated water drawn from the same area where the fish were captured, will not be held longer than 30 minutes, and will be released immediately if they show any signs of stress.

<u>Permit 1322</u>

Permit 1322 would allow the NWFSC to capture—using a beach seine and trap net—handle, and release up to 10 juvenile MCR steelhead. The NWFSC would be allowed to indirectly kill as many as one of these fish during the course of the research. The research will be carried out in two operations: one will use a beach seine in eight sets east and west of the Astoria Bridge, the other will use a trap net in four sites in Cathlamet Bay. The study targets spring and fall chinook, coho, and chum salmon. Therefore all steelhead, regardless of their origin, will be gently removed from the nets, measured, and immediately released back into the water.

There is no way of determining from which portion of the ESU the captured MCR steelhead might come. Because the study does not target MCR steelhead, it is possible (even likely) that none will even be captured while the research is being conducted. And even if they are, all fish from the ESU eventually pass the estuary. Therefore, determining their exact origin is an impossibility. It should be noted that the numbers "10 captured and one dead" are higher than have been found in past research efforts in the same areas, and are therefore overestimates included for safety and completeness' sake. However, should the maximum of one MCR steelhead be killed during this research, it will constitute a loss of less than 0.00025% of the run.

In general, the study is designed in such a way that it is unlikely to have any effect on MCR steelhead at all: the research simply targets other species. Therefore, even if the maximum estimated number of MCR steelhead were taken, the numbers are so small that it would be impossible to gauge the effect on any single population, let alone the ESU as a whole. Nonetheless, the researchers will use all due care (and the previously described mitigation measures) to ensure that any captured MCR steelhead are returned to the estuary safely.

Permit 1335

Permit 1335 would allow the USFS to capture—using a backpack electrofishing device—handle, and release up to 500 juvenile MCR steelhead and kill up to 15 of them as an indirect result of the research. The research would take place in the mainstems and tributaries of Taneum and Manastash Creeks—both tributaries to the Yakima River. All the captured fish will be held for as short a time as possible. They will be identified by species, counted, measured (length), and released. In some cases, they may be anesthetized with MS 222 (depending on the number captured and various stress factors the fish may be experiencing), but usually they will simply be released immediately after they are measured.

It is not known how many MCR steelhead rear in Taneum and Manastash Creeks; therefore, it is difficult to measure the effect—on those populations—of removing (at most) 15 juvenile fish. The finest scale (resolution) at which we *can* gauge the effect of killing that many juveniles is that of the Yakima subbasin population as a whole. At that level, the loss of 15 juveniles would constitute a 0.02% reduction in the total numbers expected to outmigrate in 2001 (Schiewe 2001). However, it is not possible to determine what adverse effect that 0.02% reduction will actually have in terms of the subbasin's population viability.

Nonetheless, even though the adverse effects associated with the research are very small, the USFS will work to minimize them even further. Aside from the mitigation measures mentioned earlier, the USFS will adhere to NMFS' backpack electrofishing guidelines; they will coordinate with other agencies to avoid duplicating sampling efforts whenever possible; and they will make only a single pass with the electrofishing unit during each transect rather than the more common two or three passes.

Permit 1340

Permit 1340 would allow researchers from OSU to observe—during snorkel surveys—120 juvenile MCR steelhead in the John Day River in Oregon. The permit would also allow the researchers to capture, handle, stomach-pump, and release another 120 juveniles. The researchers would be allowed to kill up to six of these as an indirect result of the research. The researchers will capture the fish by angling with barbless hooks. The fish will be anesthetized with MS 222 and their stomachs will be gently pumped (to determine what they are eating) using a thin—approximately two-millimeter diameter—plastic tube. Once the stomach contents have been collected, the fish will be placed in a holding basket in the stream from which they were taken. They will then be observed until they fully recover and released into a quiet part of the stream.

The six fish that may be killed during the course of the research are almost certainly an overestimate. First, the researchers performed the described operation on over 100 rainbow trout in previous years and did not cause a single fatality. Second, the researchers may not capture any MCR steelhead at all. The sites where they may observe and capture the fish are all back-up sites to areas in the Snake River basin. They will only capture and stomach-pump MCR steelhead if the primary sites are all found to be undesirable for some reason. Nonetheless, it is expected that some 228,114 steelhead will enter the Columbia River between McNary and John Day Dams (Schiewe 2001); the vast majority of those fish will be produced in the John Day subbasin. If, to err on the conservative side, only half of that number were actually produced in the subbasin, the loss of six fish would constitute a 0.005% reduction in the population.

Thus, even if the maximum number of fish are killed during the course of this research (and it is more likely that none will), it would still have an essentially unmeasurable adverse effect on the John Day population—let alone the MCR steelhead ESU. Nonetheless, the researchers will exercise care to ensure that even this loss is kept to a minimum. Aside form the mitigation measures mentioned earlier, they will use barbless hooks instead of electrofishing equipment, will only fish during the cooler parts of the day, and will restrict the sampling if drought conditions occur.

Permit 1345

Permit 1345 would allow researchers from the WDFW to capture, handle, and release up to one adult and two juvenile MCR steelhead during the course of boat electrofishing operations in the Walla Walla and Columbia Rivers. They would be allowed to kill one of the juveniles as an indirect result of the research activities. All captured juvenile fish would be held for as short a time as possible. They will be identified by species, counted, measured for length and weight, and released. No adults will be netted.

Because the boat electrofishing may take place anywhere on the Columbia River downstream from Priest Rapids Dam, there is not way to be certain of the origin of any MCR steelhead that may be encountered. Therefore, the effects of shocking two juveniles and one adult and possibly killing one of the juveniles must be placed in the context of the ESU as a whole. Thus, even if the maximum estimated number of juvenile MCR steelhead were taken, the numbers are so small (two out of more than 379,000—or less than 0.0005%) that it would be impossible to gauge the effect on any single population, let alone the ESU as a whole. As to the effects on the adult MCR steelhead, the research is designed so that no adults are encountered at all. Also, none will be allowed to be killed, and the researchers will turn off the electrofishing equipment as soon as any are spotted.

Thus, even if the maximum number of steelhead are taken, the result would be an absolutely negligible effect on the species as a whole. Nonetheless, even though the effects are extremely small, the researchers will work to reduce them further. Aside from the mitigation measures mentioned earlier (page 6), they will conduct the boat electrofishing in times and at locations where there are not likely to be any MCR steelhead at all. The surveys will be conducted in the fall and, because the researchers are looking for warm water fish and specifically trying to avoid salmonids, they will primarily operate in areas that steelhead avoid—warm backwater sloughs, oxbow lakes, and ponds rather than main channel habitats.

Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State, tribal and local government actions will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may encompass changes in land and water uses—including ownership and intensity—any of which could impact listed species or their habitat. Government actions are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and speculative. This section identifies representative actions that, based on currently available information, are reasonably certain to occur. It also identifies some goals, objectives, and proposed plans by government entities. However, NMFS is unable to determine at this time whether any of the proposals will actually result in specific actions.

<u>Representative State Actions</u>

Each state in the Columbia River basin administers the allocation of water resources within its borders. Most streams in the basin are over-appropriated, even though water resource development has slowed in recent years. Washington closed the mainstem Columbia River to new water withdrawals, and is funding a program to lease or buy water rights. It is hoped that this will improve water quantity over the long term. State and local governments are cooperating with each other and Federal agencies to increase environmental protections, including better habitat restoration and hatchery and harvest reforms. NMFS also cooperates with the state water resource management agencies in assessing water resource needs in the Columbia River basin and in developing flow requirements that will benefit listed fish. During low-water years, however, there may not be enough flow to meet the fishes' needs. Moreover, these government efforts could be reduced or even discontinued, so their cumulative effect on listed fish is unpredictable.

Most future actions in Oregon are described in the Oregon Plan for Salmon and Watershed (OPSW). Along with significant harvest and hatchery measures, the OPSW includes the following habitat-related programs designed to benefit salmon and watershed health:

- Oregon Department of Agriculture Water Quality Management plans.
- Oregon Department of Environmental Quality Total Maximum Daily (pollutant) Loads (TMDLs) in targeted subbasins.
- Oregon Watershed Enhancement Board funding programs for watershed enhancement and land and water acquisitions.
- ODFW and Oregon Water Resources Department programs to enhance flow restoration.

If these programs are actually implemented, there may be some improvement in various habitat features considered important for the listed species. The Oregon Plan also identifies several private and public cooperative programs for improving the environment for listed species. The success of such programs will depend on continued interest and cooperation among the parties involved.

The state of Washington has various strategies and programs designed to improve the habitat for listed species and assist in recovery planning. One such is the Salmon Recovery Planning Act—a framework for developing watershed restoration projects. The state is also developing a water quality improvement scheme through the development of TMDLs. As with the Oregon initiatives, these programs could benefit the listed species if implemented and sustained.
The Washington state government is cooperating with other governments to increase environmental protection for listed ESUs, including better habitat restoration, hatchery and harvest reforms, and water resource management. The following is a list of many of Washington's major efforts to protect and restore salmonids and their habitat.

- Washington Wildlife and Recreation Program
- Wild Stock Restoration Initiative

- Joint Wild Salmonid Policy
- Governor's Salmon Recovery Office
- Conservation Commission
- Salmon Recovery Lead Entities
- Salmon Recovery Funding Board

In the past, each state's economy was heavily dependent on natural resources and largely predicated upon intense resource extraction. The states' economies have changed a great deal over the last two decades and these changes are likely to continue. In general there will be less large-scale resource extraction, extraction methods will be more targeted, and other economic sectors are likely to see significant growth. Moreover, growth in new businesses is creating urbanization pressures with increased demands for buildable land, electricity, water supplies, waste disposal sites and other infrastructure.

Economic diversification has contributed to population growth and movement in the states—a trend likely to continue for the next few decades. Such population trends will: place greater demands in the action area for electricity, water, and buildable land; affect water quality directly and indirectly; and increase the need for transportation, communication, and other infrastructure development. The impacts associated with economic and population demands will affect habitat features (such as water quality and quantity) that are important to the survival and recovery of the listed species. The overall effect is likely to be negative unless carefully planned for and mitigated.

Some of the state programs described above are designed to address these impacts. Oregon also has a statewide land use planning program with growth management and natural resource protection goals. Washington enacted a Growth Management Act to help communities plan for growth and address growth impacts on the natural environment. If the programs continue they may help lessen some of the potential adverse effects identified above.

<u>Local Actions</u>

Local governments will be faced with similar, but more direct pressures from population growth and movement. There will be demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure, and other resources. The reaction of local governments to such pressures is difficult to assess at this time. In the past, local governments in the action area generally accommodated additional growth in ways that adversely affected listed fish habitat. Also, there is little consistency among local governments in dealing with land use and environmental issues, so any positive effects that local government actions have on listed species and their habitat are likely to be scattered throughout the action area.

In both Oregon and Washington local governments are considering ordinances to address how different land uses affect fish and habitat health. These programs are part of state planning structures; however, local governments in Oregon are likely to be cautious about implementing new programs because of the passage of an initiative that would add a takings amendment to the state constitution. Some local government programs may qualify for a limit under the NMFS' ESA section 4(d) rule which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect such actions have on listed species. Overall, without comprehensive and cohesive beneficial programs—and the sustained application of such programs—it is not likely that local actions will have measurable positive effects on listed species and their habitat, and may even contribute to further degradation.

Tribal Actions

Tribal governments will continue to participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat. The effect that changes in tribal forest and agriculture practices, water resource allocations, and land uses will have on listed fish and their habitat is difficult to assess for the same reasons discussed above under State and Local Actions. The earlier discussions related to growth impacts also apply to tribal government actions. Tribal governments will need to put into practice comprehensive and beneficial natural resource programs if they are to have measurable positive effects on listed species and their habitat.

Private Actions

The effects of private actions are the most uncertain. Private landowners may change, intensify, or diminish their current land uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may arise out of population growth and economic pressures. Changes in ownership patterns will have unknown impacts. There is no way to predict whether any of these private actions will take place, and gauging their possible effects is even more difficult.

Summary

Non-Federal actions are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze considering the large geographic scope of this opinion, the different resource authorities in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them “reasonably foreseeable” in its analysis of cumulative effects.

Integration and Synthesis of Effect

The vast majority (more than 94%) of the MCR fish that will be captured, handled, observed, etc., during the course of the proposed research (a total of 6,418 juvenile fish and 18 adults) are expected to survive with no long-term effects. Moreover, most capture, handling, and holding methods will be minimally intrusive and of short duration. Because so many of the captured fish are expected to survive the research actions and so few (a maximum of 1.7%) of the total MCR steelhead outmigration will be affected in even the slightest way, it is likely that no adverse effects will result from these actions at either the population or the ESU level. Therefore, adverse effect must be expressed in terms of the individual fish that may be killed during the various permitted activities. The following table summarizes these effects for each permit.

Table 2. Maximum Annual Takes of Threatened MCR Steelhead

	Adult					Juvenile				
Permit	HANDLE			MORTALITY		HANDLE			MORTALITY	
Action	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT	CFT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1056							300		200	10
1140							2			1
1156		12					35			1
1229							6			1
1252							10			1
1290							12			1
1291							3,936	394		87
1292							23			1
1293							28			1
1317							500			25
1318		5					20			1
1321							200	200		20
1322							10			1
1335							500			15
1340							240			6
1345		1					2			1
TOTALS		18					5,824	594	200	173

Key: CFT = Collect for Transport; C,H,R = Capture, Handle, Release; C, T/M, R = Capture, Tag/mark, Release.

If the total amount of estimated lethal take for all research activities—373 juvenile MCR steelhead—is expressed as a fraction of the 379,264 fish expected to reach The Dalles Dam, it represents a loss of 0.10% of the run. However, and for a number of reasons, that percentage is in actuality probably much smaller. First, as stated earlier in the Opinion, the anticipated outmigration of MCR steelhead is some number larger than the 379,264 fish expected to arrive at The Dalles Dam. It is impossible to say how much bigger that number would be if we had figures for the Klickitat and Hood Rivers and other, smaller tributaries between The Dalles and Bonneville Dams, but it is certain that using the 379,264 figure to represent the entire MCR steelhead outmigration is a very conservative estimate. Second, it is important to remember that every estimate of lethal take for the proposed studies (except for the direct take in Permit 1056) has purposefully been inflated and it is therefore very likely that fewer than 373 juveniles will be killed by the research—possibly many fewer. Third, some of the studies will specifically affect steelhead in the smolt stage, but others will not. These latter studies are described as affecting "juveniles," which means they may target steelhead yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the 0.10% figure was derived by (a) underestimating the actual number of outmigrating MCR steelhead smolts, (b) overestimating the number of fish likely to be killed, and (c) treating each dead MCR steelhead as a smolt when some of them clearly won't be. Thus the actual number of juvenile MCR steelhead the research is likely to kill is undoubtedly smaller than 0.10%—perhaps as little as half (or less) of that figure.

But even if the entire 0.10% of the juvenile MCR steelhead population were killed, and they were *all* treated as smolts, it would be very difficult to translate that number into an actual effect on the species. Even if the subject were one adult killed out of a population of one thousand (0.10% is another way of expressing the fraction "one-thousandth"), it would be hard to resolve an adverse effect. And in this instance, that effect is even smaller because the loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. In the case of Deschutes River summer steelhead (part of the MCR steelhead ESU), only 1-12% of the outmigrating smolts survived to return as adults between 1976 and 1994 (and in most years, the number was near the lower end of that range) (ODFW and WDFW 1998). This indicates that (conservatively) something near 90% of the smolts leaving the Deschutes River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the 0.10% figure would likely be killed during the natural course of events. Therefore the research, even in the worst possible scenario, would kill likely the equivalent of one adult out of ten thousand—a negligible adverse effect on the ESU.

Nonetheless, regardless of its magnitude, that negative effect must be juxtaposed with the benefits to be derived from the research (see descriptions of the individual permits). Those benefits range from finding ways to improve salmonid survival through the Columbia River Hydropower System (Permit 1291) to determining the degree to which they are being harmed during their freshwater residence (Permit 1318) to providing basic information on the means to restore their habitat (Permit 1322). In all, the fish will derive some benefit from every permit considered in this Opinion. The amount of benefit will vary, but in some cases it may be significant. Therefore, in deciding whether to issue the permits considered here, NMFS must compare the tangible benefits they will produce (some of which are potentially significant) with the negligible adverse effects they will cause. Moreover, NMFS must weigh similar factors (benefit versus adverse effect) when deciding whether the contemplated actions will appreciably reduce the likelihood of the MCR steelhead's survival and recovery—the critical determination in issuing any biological opinion.

Conclusions

After reviewing the current status of the threatened MCR steelhead, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NMFS' biological opinion that issuance of the proposed permits is not likely to jeopardize the continued existence of threatened MCR steelhead nor destroy nor adversely modify their critical habitat.

Coordination with the National Ocean Service

The activities contemplated in this Biological Opinion will not be conducted in or near a National Marine Sanctuary. Therefore, these activities will not have an adverse effect on any National Marine Sanctuary.

Reinitiation of Consultation

Consultation must be reinitiated if: The amount or extent of annual take specified in the permits is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response NMFS within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation the agency must explain its reasons for not following the recommendations.

The objective of this consultation is to determine whether the proposed actions, the funding and issuance of scientific research permits under section 10(a)(1)(A) of the ESA for activities within the states of Oregon and Washington, are likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, a conservation recommendation(s) will be provided.

Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species, and salmon off the coasts of Washington, Oregon, and California. Pursuant to the MSA, the PFMC has designated freshwater EFH for Pacific salmon; it includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e. natural waterfalls in existence for several hundred years)(PFMC 1999). Marine EFH for Pacific salmon in Oregon and Washington includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore.

Proposed Action and Action Area

For this EFH consultation the proposed actions and action area are as described in detail in the ESA consultation above. The actions are the funding and issuance of a number of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the middle Columbia River basin. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). The impacts of the proposed actions on these species' EFH are assessed based on this information.

Effects of the Proposed Action

Based on information submitted by the action agencies and permit applicants, as well as NMFS' analysis in the ESA consultation above, NMFS believes that the effects of this action on EFH are likely to be within the range of effects considered in the ESA portion of this consultation.

Conclusion

Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NMFS has determined that the proposed actions are not likely to adversely affect Pacific salmon EFH.

EFH Conservation Recommendation

NMFS has no conservation recommendations to make in this instance.

Consultation Renewal

The action agencies must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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